THE PSYCHOLOGY OF ELEMENTARY SCHOOL SUBJECTS

GARRISON AND GARRISON

WITHDRAWN
FROM B'ham-Sou.
College Lib.

LIBRARY
of
BIRMINGHAM-SOUTHERN
COLLEGE

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE

THE PSYCHOLOGY OF ELEMENTARY SCHOOL SUBJECTS

BY

S. C. GARRISON, Ph.D.

PROFESSOR OF EDUCATIONAL PSYCHOLOGY
GEORGE PEABODY COLLEGE FOR TEACHERS

WITHDRAWN
FROM B'ham-Sou.
College Lib.

AND

K. C. GARRISON, Ph.D.

ASSOCIATE PROFESSOR OF PSYCHOLOGY
NORTH CAROLINA STATE COLLEGE

JOHNSON PUBLISHING COMPANY
RICHMOND ATLANTA DALLAS
NEW YORK CHICAGO

373

Garrison

44386

Copyright, 1929
JOHNSON PUBLISHING COMPANY

Printed and bound in the
United States of America

LB
1051
.G65

WITHDRAWN
FROM B'ham-Sou.
College Lib.

TO
OUR FATHER AND MOTHER

EDITORS' INTRODUCTION

This volume has been prepared for the benefit of teachers in the elementary schools with the particular needs of the classroom in mind. The investigation and research underlying this valuable work cover a period of fifteen years or more, during which time the authors have patiently collected scientific data to support the position they take. They have assembled individual pupil records of the child's entire educational experience. These records cover the physical, mental, and spiritual growth of the child and from this body of information the writers have built up their theory of the application of psychology to teaching.

During the many years in which the authors were making their study, they not only collected data about child growth and learning but at the same time they carefully observed classes of children and tried out their theory in the classroom. This articulation of theory and practice assures the teacher that the suggestions contained in the book will find useful application in the daily work.

The Psychology of Elementary School Subjects will be welcomed by the supervisor who is seeking a solution of her problems as well as by teachers and students of elementary education. It will also be of great practical help to teachers in elementary schools.

Thomas Alexander
Rosamond Root

Digitized by the Internet Archive
in 2023

https://archive.org/details/bwb_P1-AFM-724

PREFACE

As the title of this volume, *The Psychology of Elementary School Subjects,* implies, the greater portion of the book is concerned with the psychology of the elementary school subjects. However, in order to give the underlying psychological principles, the opening chapters are devoted to a consideration of the two central problems of educational psychology, that part of the science of psychology which is concerned with the growth and development of the individual, especially as this is conditioned by the school. The two major problems of educational psychology are concerned with individual differences and learning. There are other problems, *e.g.*, the original nature of man and the relative influence of heredity and environment, but in the main these are problems which are treated in either general or child psychology. Such consideration as is necessary in a text like this may be given in connection with the two topics mentioned above. Indeed, as far as the school is concerned, the problem of individual differences is really one of learning. It resolves itself into problems of individual differences in the ability to profit by instruction.

In this text the authors have thought best to eliminate many topics which, although they are of interest and of value to the teacher, are generally treated in an introductory course in psychology. The inclusion of these would be duplication of material, which the writers have attempted to avoid. The topics treated here have more direct reference to growth and development in the school environment.

The work of the teacher rests primarily upon the science of psychology as applied to school situations. Education has been defined in many ways. Probably a good point of view with respect to education is that it is a process of setting up situations for the purpose of controlling, modifying, and developing the behavior of the child so as to produce an adult who behaves in certain desired ways. Not only is it necessary to provide for the development of the individual but this development must be guided toward desired ends. Educational psychology is the science which treats of the development of the child ; therefore the theory and practice of education, as far as these are based on the laws of learning, rest on the science of psychology.

Educational psychology is concerned with the methods of achieving the aims of education. The decision as to what the aims of education are must be left largely to philosophy and the social sciences, except where these aims are concerned with the development of the child. It is not too much to say that once the aims of education are determined the processes by which they are to be attained are subjects for investigation by psychology. The aims so determined may be psychologically unattainable, but if attainable, psychology should be able to point the way.

It is not the province of psychology to investigate the aims and ideals of education except as they are concerned with the growth of the individual. Psychology does not treat of values. It does not say that we should strive to build certain attitudes toward life. This lies within the province of other fields like ethics and philosophy. It does say, however, that certain attitudes may make a more efficient individual.

There are many good teachers who know little of psychology in a scientific way but who have nevertheless developed considerable skill in understanding problems of human behavior. Procedure in the schoolroom is largely concerned with methods of facilitating learning. It is well then not to leave to chance the discovery of such methods by the teacher, but rather to give systematic instruction in those phases of psychology which will be helpful in guiding the pupil in his work. A teacher who knows the principles upon which his methods are based should teach with greater pleasure and efficiency than one who has merely developed a technique, the reasons for which he does not understand and which may be right or wrong. However, a study of psychology will not in itself make a good teacher. The student must learn how to apply his information under different circumstances and how to modify conditions so as to make situations favorable for learning.

Many authors and publishers have generously granted permission for the use of quotations from their publications. In all cases credit is given on the page upon which the excerpt appears. However, our debt to these authors and publishers is gratefully acknowledged here.

S. C. Garrison
K. C. Garrison

CONTENTS

PAGE

EDITORS' INTRODUCTION vii

PREFACE ix

CHAPTER

I. INDIVIDUAL DIFFERENCES 1

Nature and amount of individual differences in single traits — The normal probability curve — Why the subject of individual differences is important — Questions and Exercises — Selected References.

II. CAUSES OF INDIVIDUAL DIFFERENCES . . . 16

The Concept of Heredity — Racial differences — Differences due to family — Sex differences — Maturity and individual differences — The Concept of Environment — Environmental influences on prenatal development — Environmental influences on postnatal development — Relation between physical and mental traits — Why it is important to measure differences in children — Questions and Exercises — Selected References.

III. MEASUREMENTS 42

Origin of measurement in education — The meaning of mental age — The meaning of intelligence quotient — The meaning of the accomplishment quotient — What is meant by norms? — What is a standardized test? — Uses of standardized tests — Reliability and validity —

CHAPTER PAGE

Mental and educational tests — General intelligence — Questions and Exercises — Selected References.

IV. MEASURING DIFFERENCES IN CHILDREN . . 59

Purpose of this chapter — Tabulation of data — Central tendencies — The mean — The median — The mode — Questions and Exercises — Selected References.

V. MEASURES OF INDIVIDUAL DIFFERENCES . . 77

Purpose of this chapter — The range — The mean deviation — The standard deviation — Measurement of variability — Measures of relationship —How to find the coefficient of correlation — Questions and Exercises — Selected References.

VI. LEARNING 92

What is learning? — The physiological basis of learning — Stimulus-response hypothesis — Change and learning — Self-activity and learning — Ability to learn — Mental organization and learning — Transfer and learning — Spontaneous movements — Questions and Exercises — Selected References.

VII. GENERAL PRINCIPLES OF LEARNING . . . 113

Trial and error learning — Good teaching has definite goals in view — Random movements — Contiguity — Experience and learning — Attention and learning — Attention, interest, and learning — Attention and interest as an end in education — The span of attention and learning — Perceptual learning — Instincts and learning — Habit and learning — Frequency and learn-

CHAPTER PAGE

ing — Recency, intensity, and primacy — Forgetting — Questions and Exercises — Selected References.

VIII. SPECIAL ABILITIES AND DISABILITIES IN LEARNING 144

The problem of general and special abilities — The meaning of special ability — Causes of special abilities and disabilities — Unevenness in ability of bright, dull, and average children — Success or failure and special abilities — The teacher — Classification of pupils and special abilities — Questions and Exercises — Selected References.

IX. LEARNING AND MOTIVATION 159

The relationship between biological and social motives — Overcoming difficulties or obstacles — Motives growing out of individual standards — Motivation as it depends upon the previous experience of the child — Organization and presentation of the subject matter — Interest and motivation — Praise and reproof in motivation — Knowledge of progress — Standard tests and motivation — The class as a motivating factor — School morale and motivation — Personality of the teacher — Community spirit — Establishment of ideals — Fundamental principles in motivation — Questions and Exercises — Selected References.

X. THE PSYCHOLOGY OF THE TEACHER . . . 187

What is the function of the teacher? — The teacher's personality — Characteristics of successful teachers — The development of personality — The teacher's preparation — Studies of the causes of failures — Self-analysis — The teacher and the teaching situation — Questions and Exercises — Selected References.

CHAPTER PAGE

XI. THE PSYCHOLOGY OF LANGUAGE 207

What is language? — Biological basis of language — Beginnings of language in the race — Beginnings of language in the individual — How words acquire meaning — Relation between language and mental development — Relation between language and thinking — Language a mode of reaction — Language as habit — Language and social intercourse — Exact expression and word meaning — Two aspects of language reactions — Language as stimulus and response — Questions and Exercises — Selected References.

XII. THE PSYCHOLOGY OF LANGUAGE (*Continued*) . 230

General aims — Specific aims in language instruction — Time devoted to English — Growth in language ability — Initiative and language training — Language skills needed — Are children interested in language work? — Interest and achievement in language work — Interest and experience in language work — Motivation of composition work — Building desirable attitudes — Grammar and language — Studies of errors — Sentence structure — Individual differences — Measurement and diagnosis — Questions and Exercises — Selected References.

XIII. READING 267

Importance of reading — Reading objectives in general — What is reading? — Reading and studying — Reading and the other school subjects — Children's interests in reading — Relation of reading and intelligence — Questions and Exercises — Selected References.

XIV. PSYCHOLOGICAL FACTORS INVOLVED IN READING 288

Reading a highly complex form of behavior — Distinction between oral and silent reading

CHAPTER PAGE

— Silent reading — Oral reading — Knowledge and Skills Influencing the Development of Comprehension — Reading readiness — Psychology of word meaning — Vocabulary growth — Developing a meaning vocabulary — Perception of words — Fluency and span of recognition — Anticipation of meaning — Interpretation — Analysis, association, and judgment — Organization — Retention and reproduction — Rate of reading and comprehension — Interest and motivation — Attention and mental set and comprehension — Other factors affecting comprehension in reading — Factors in the Development of Rate in Reading — Development of rate in reading — Skills influencing rate of reading — Motor coördinations and reading rate — Fluency and accuracy of perceptions and rate of reading — Attitude and mental set and rate of reading — Interest and motivation and reading rate — Other factors influencing rate in reading — Questions and Exercises — Selected References.

XV. MEASUREMENT IN READING 333

Types of tests — Informal tests — Uses of standardized tests — The classification of pupils by means of standardized reading tests — Provisions for individual differences — Diagnostic and remedial measures in reading — Questions and Exercises — Selected References.

XVI. THE PSYCHOLOGY OF SPELLING . . . 351

Present-day aims of the teaching of spelling — Economy in word lists — Class lists of words — Presentation of words — Attitude or mental set — Ability and achievement in spelling — Maturity and sex and achievement in

CHAPTER PAGE

spelling — Imagery — Memory — Pronunciation — Meaning — Questions and Exercises — Selected References.

XVII. THE PSYCHOLOGY OF SPELLING (*Continued*) . 374

Selection and drill — Motivation — The teacher and motivation — Tests and motivation — Transfer — Order of psychological processes in learning to spell a word — Classification of errors — Position of error in words — Cause, prevention, and treatment of errors — Interest — Unfavorable causes of a general nature — Prevention of errors — Treatment of errors — Disability in spelling — Diagnosis and remedial instruction in spelling — Measuring spelling achievement — Questions and Exercises — Selected References.

XVIII. THE PSYCHOLOGY OF HANDWRITING . . . 405

Aim — Specific aims — Standards for judging handwriting instruction — Time devoted to handwriting instruction — Writing a complex process — Movements — Handwriting as habit — Speed and quality in handwriting — Growth in handwriting ability — Left-handedness and handwriting — Interest and motivation — Intelligence and handwriting — Measurement in handwriting — Individual differences in handwriting — Diagnosis and remedial treatment — Questions and Exercises — Selected References.

XIX. THE PSYCHOLOGY OF ARITHMETIC 429

Historical — Learning to count as a preparation for later numerical work — The relation of the number concept to the written symbol — When should formal instruction be introduced? — What are the aims of arithmetic in the elementary school? — What is the function

CHAPTER PAGE

to be developed? — Upon what factors does ability in arithmetic depend? — Motivation in arithmetic — Formation of habits — What drills are needed? — Drill on the fundamentals as a part of the recitation — Conditions of drill — Questions and Exercises — Selected References.

XX. THE PSYCHOLOGY OF ARITHMETIC (*Continued*) . 461

Simplicity of explanations — Understanding of principles versus memorizing — Some difficulties encountered — Principles of economy in arithmetic study — Will learning a process transfer to the reverse process? — Relationship between achievement in arithmetic and achievement in the other elementary school subjects — Provisions for individual differences — Differences in intelligence — Differences due to habits of work — Sex differences — Questions and Exercises — Selected References.

XXI. MEASURING THE RESULTS OF INSTRUCTION IN ARITHMETIC 479

Measurements — What are the elements to be measured? — General survey tests in arithmetic — Tests for ability to formulate the correct solution of problems — Qualities of a good examination in arithmetic — Questions and Exercises — Selected References.

XXII. THE PSYCHOLOGY OF DRAWING 491

What is meant by drawing? — Drawing as a form of expression — Psychological analysis of drawing ability — What are the aims of art education in the grades? — Factors affecting the acquisition of skill in drawing — Children's interests in drawing — Drawing and intelli-

CHAPTER PAGE

gence — Individual differences in ability to draw — Questions and Exercises — Selected References.

XXIII. THE PSYCHOLOGY OF MUSIC 508

Aim of music education — Music a form of expression — Abilities functioning in musical education — What is meant by appreciation? — The inheritance of musical ability — Motivating the learner — Can a sense of rhythm be developed? — Individual needs — Tests of musical ability — Questions and Exercises — Selected References.

XXIV. THE PSYCHOLOGY OF THE SOCIAL STUDIES . 524

Aims for teaching the social studies — Methods of selecting the materials of instruction in the social studies — Difficulties in teaching the social studies — Directed study in the social studies — Mental processes involved in the social studies — What historical content should be used in the grades? — Provisions for individual differences in the social studies — Measurement in the social studies — Questions and Exercises — Selected References.

XXV. THE PSYCHOLOGY OF NATURE STUDY . . 544

Historical — Aims of nature study instruction — Nature study as related to children's interests — Organization in nature study teaching — The teacher and nature study — Study habits in nature study — The development of scientific concepts — What science information do children possess? — Relation to other subjects — Appreciation in nature study — Nature study as related to individual differences — Questions and Exercises — Selected References.

THE PSYCHOLOGY OF ELEMENTARY SCHOOL SUBJECTS

CHAPTER I

INDIVIDUAL DIFFERENCES

Probably no study has influenced educational procedures more than that of individual differences. The study of differences between people originated in the psychological laboratory where it was not at first considered important. However, it has, in the judgment of the educator, assumed a place so important that no educational procedure can be arranged or no piece of research dealing with instruction carried out unless differences between pupils are first taken into consideration. In fact, our philosophy of education is largely determined by our ideas concerning these differences. Should the process of education be used to lessen or accentuate differences? Is education a means or an end, or both? Are differences due to heredity or to environment? What effect, if any, do environmental factors have in decreasing or increasing innate differences? At the present time one's philosophy of education is largely a reflection of the answer he gives to problems arising in the study of differences between children.

The scientific study of individual differences is a comparatively new one. Until recent times little attention was given to the fact that individuals are unlike. Large differences were thought of as abnormalities and in many cases people varying widely in certain ways, as the feeble-minded, were looked upon with scorn and contempt rather than as persons to be pitied and helped. Most of the scientific work in this field has been done in the last few decades. To Sir Francis Galton (1822–1911), a noted English psychologist, and Alfred Binet (1857–1911), an equally renowned French psychologist, we owe a great deal because they did much toward giving us the technique necessary for a scientific approach to the problem.

Galton was largely occupied with studies of individual differences. The titles of two of his books, *Hereditary Genius* and *Inquiries into Human Faculty and Its Development*, published in 1869 and 1883 respectively, indicate the lines along which he worked. While the results from his researches were significant and far-reaching in their influence on later investigators, his greatest contribution to the study of individual differences lies in the fact that he attempted to put his results on a quantitative basis. To his genius we owe in a large measure the beginnings of statistical technique by means of which we are able to study differences.

Galton was not only interested in the measurement of traits but in their inheritance as well. He was one of the first to question the inheritance of acquired characters and to give a quantitative statement as to inheritance. His first principle of inheritance is called his Law of Ancestral Inheritance. This law briefly stated is as follows: The two parents of the offspring contribute together, on the average, one half of the traits, each parent contributing approximately one quarter. The grandparents each, on the average, contribute one sixteenth, or, all together, one fourth. The eight great-grandparents each contributes one sixty-fourth, or, all together, one eighth, and so on.

Galton found that parents deviating in any trait from the average tended to produce offspring nearer the average than they themselves. Thus he found that in general the sons of tall men were shorter than their fathers while the sons of short men were taller than their fathers. This principle he called the Law of Filial Regression. While the principles set forth by Galton have been questioned somewhat, the fact remains that he attempted to introduce quantitative methods into the study of the differences in, and the inheritance of, traits.

Binet's contribution to the study of individual differences can hardly be estimated. He, as had other psychologists, experimented during the last decade of the nineteenth century with tests which he hoped would differentiate persons possessing various degrees of ability. During the first decade of the present century he successfully devised a measuring scale which does differentiate various degrees of mental ability. But Binet did more than merely devise tests; he evaluated the different methods of studying the individual and pointed the way to future progress. Peterson[1] says of Binet and his associates that while they "classified the main problems of individual psychology as: (1) the study of the extent and the nature of the variations of the psychic processes from one individual to another, and (2) the determination of the interrelations of these various processes in any single individual as to whether they are mutually dependent or whether some are fundamental processes upon which all others depend, it is clear that their interest was really more in the individual than in the processes themselves. What they were after was a series of tests which would bring out most clearly the large differences in ability among different persons."

---

[1] Peterson, Joseph. *Early Conceptions and Tests of Intelligence*, p. 97. Copyright, 1925, by World Book Company, Yonkers-on-Hudson, New York.

The union in America of the two lines of effort represented by Binet and Galton has produced much fruit in the productive work of Cattell, Thorndike, Terman, Goddard, and many others. To a large measure, scientific education is the product of their work. A detailed discussion of this later contribution is not given here but will be presented in connection with the educational problems upon which they shed light.

Nature and amount of individual differences in single traits. The average man has no idea of the wide differences in ability in any trait which may exist between individuals. If we study a given trait possessed by a group of children of the same age, we find differences which are astonishingly large, provided the children have not been selected on the basis of that trait. Tables I and II are especially interesting because of the wide range of abilities shown in the same grade. In Table I are the scores made on

Table I. Showing the T-Scores Made by the Pupils of a Small Junior and Senior High School on the Thorndike-McCall Reading Scale

Grade	7	8	9	10	11	12
Score						
86						
84	1					1
82					1	2
80	3			2	1	1
78	2	3		2	2	1
76			3	2	4	3
74	3	7	3	4	3	2
72			3			2
70	2	6	8	3	1	
68			2			1
66	3	6	3	4	3	3
64	1	1	2	2	3	2
62	1	6	4	3	2	3
60	3	2	2	1	4	5
58	6	3	2	2	2	3
56	3	1		1	3	2
54	1		1		1	
52			2			2
50				2		1
48	1					
46	1	1	1			
44						
42						
40						
38						
36						
34			1			
Norms	58.5	61	62.3	63.5	65.3	68

the Thorndike-McCall Reading Scale by the pupils of a small junior and senior high school. It will be noticed that in every grade there are pupils making rather low scores while others make high ones.

TABLE II. SHOWING SCORES MADE ON THE COURTIS ARITHMETIC TEST BY CERTAIN GROUPS[1]

GRADE	G1	G2	G3	G4	WHOLE G
VII	42	34.2	22.2	21.5	29.8
VI	36	22	20.9	18.3	24.4
V	38	23.7	13.1	11.7	21.8
IV	18	16.7	7.2	11.7	13.4

It can be seen from the norms * that there are pupils possessing seventh-grade reading ability in each of the grades while others in the same grade possess reading ability equal to that of the average twelfth-grade pupil. Practically all these pupils have had all their training in the same school and under the same teachers, yet large differences are found in their reading ability.

Table II shows an interesting situation. Here four grades, in each of which there were thirty-two pupils, were divided into four groups on the basis of teachers' judgments and mental tests. There were eight pupils in each group. These pupils were all given the Courtis Arithmetic Tests and the average score for each group found. Notice that G1 (the best group) in the sixth grade did better than any group in the seventh grade except the best group.

---

[1] Garrison, S. C. "Variation within the Grammar Grades," George Peabody College for Teachers, *Contributions to Education*, No. 8, p. 20. 1922.

* A norm for any test represents the ability possessed by the average child in the group for which the norm is representative. Generally, the median score for a large group of persons is taken as the norm. The median score is the middle one when the scores are arranged in order from highest to lowest or lowest to highest.

TABLE III. AVERAGE NUMBER OF ERRORS MADE BY THE MEMBERS OF EACH GROUP[1]

GRADE	G1	G2	G3	G4
VII	4.3	13.6	17.7	24
VI	5.6	14.3	16.6	25.6
V	5.2	10.2	15.2	19.3
IV	4.2	9.2	17	19.7

The facts brought out in this table are very significant. The thirty-two pupils in the G1 groups could probably have been taught arithmetic together about as well as the thirty-two pupils in the seventh grade. In most school subjects, probably, the better one half of a lower grade at the end of a school year is superior to the poorer one half of the grade immediately above. Table III shows the average number of errors made by each group on a number of tests. Notice that the average number of errors made by G4, the poorest group, is from four to five times as large as that made by the good group.

---

[1] Garrison, S. C. *Op. cit.*, p. 25.

In the early days of American education pupils were not classified into groups. Later, the chief argument used in favor of the graded school was that children could then be classified into similar levels of ability. In those days only differences due to age and maturity seem to have been noted. At least the wide differences we now know to exist between pupils of the same age were overlooked. The fact that individuals vary so widely in school abilities makes one of the hardest problems with which the school has to deal. It now seems that our problem is to determine how to break down the formalism which has grown up about the grade idea so that instruction may be adapted to the abilities of the individual pupil. The way in which this problem is being solved will be taken up in later chapters under the topic, "Provisions for Individual Differences."

The normal probability curve. Suppose we were able to measure the standing height of each of one hundred thousand white men selected at random. Suppose again that all measurements were taken to the nearest one fourth of an inch. In the first group, a few very short men would be found. In the next tallest group, there would be a few more than in the first group. In the next, still a few more, and so on until we reach the middle group. Here we should find the most numerous group. As we continued to progress from the middle group toward the group containing the tallest men, counting the number in each group, we should likely find fewer and fewer men in the

TABLE IV. SHOWING THE FREQUENCY DISTRIBUTION FOR ADULT MALES BORN IN GREAT BRITAIN[1]

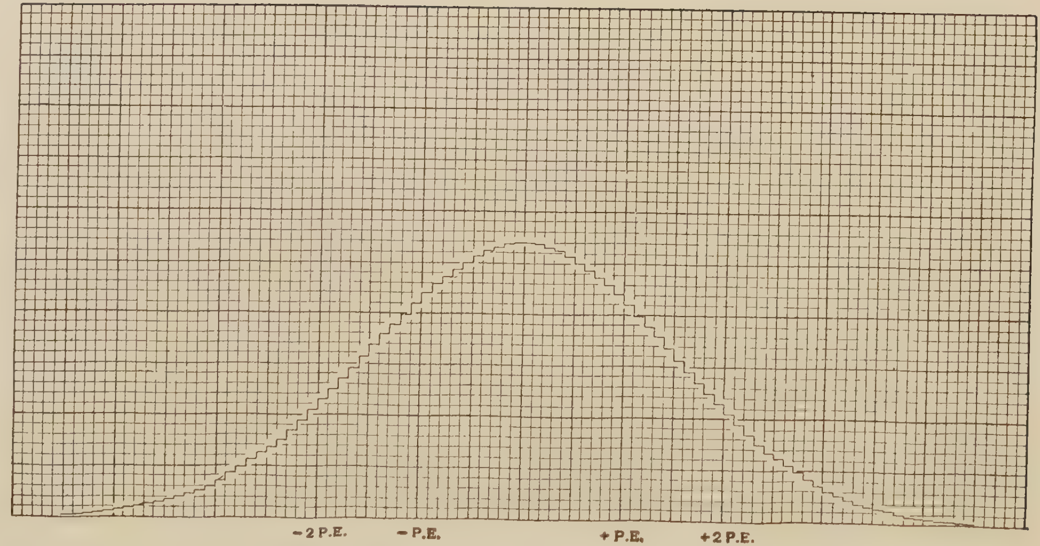
HEIGHT IN INCHES	FREQUENCY
57	2
58	4
59	14
60	41
61	83
62	169
63	394
64	669
65	990
66	1223
67	1329
68	1230
69	1063
70	646
71	392
72	202
73	79
74	32
75	16
76	5
77	2
Total	8585

groups. Again, after the number of men in each group has been found, if we should compare the numbers in the various groups we should find approximately the same number in the shortest and tallest, in the next shortest and the next tallest the same numbers, and so on. Table IV shows the heights of

---

[1] Yule, G. U. *An Introduction to the Theory of Statistics*, p. 88. Charles Griffin and Company, Ltd., London. 1917.

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE



▦ =1% ——— = P.E. ——— = A.D. ——— = S.D.

NORMAL SURFACE OF FREQUENCY

Area of Frequency Surface = 1000 □
Highest Ordinate = 2.7 P.E.

FIGURE 1

8585 men taken to the nearest inch. An examination of the table shows that these heights roughly fall into a normal probability curve. This curve is frequently called the Gaussian Curve because Gauss, the celebrated mathematician, first described its properties.

The most outstanding fact with regard to mental and educational traits for an unselected group is that they tend to give, when measured and the measurements tabulated and plotted, a curve approximately of this shape. A normal probability curve is given in Figure 1. It will be seen that the curve is bell shaped with its highest point in the center.

At first it gradually slopes from the middle toward the base line. This slope becomes more pronounced as it approaches the base line and until this line is almost reached; then it flattens out and approaches the line very slowly. In other words, most of the individuals of a certain age, when measured as to any trait, fall near the center or average. Gradually, fewer and fewer persons are found as the curve approaches the base line. It is customary when tabulating and plotting measurements to place the high scores to the right and the low to the left.

This curve is frequently called the normal frequency curve, the normal probability curve, or the curve of error. Its properties will be discussed in a later paragraph in connection with measures of variability. Experience has shown that, when plotted, most data secured from psychological and educational measurements fall into a curve approximately similar to the normal probability curve. However, this is only true when we are dealing with an unselected group.

Quetelet, a Belgian astronomer, first applied the theory of probability to problems of individual differences. Galton, however, was the first to see the real significance of the measurement of traits and he applied the theory on a very large scale. In his work Galton found that the probability curve and the frequency or variability curve are similar. His Law of Filial Regression and Law of Ancestral Inheritance he treated mathematically. Followers of Galton have greatly expanded his use of quantitative methods in dealing with human problems and have developed the science of *biometry*, that is, mathematics or statistics applied to the study of traits of living things. This method of work is probably as important for research workers in the biological sciences as is mathematics for research workers in other fields.

Why the subject of individual differences is important. Only by a true notion of individual differences can a fundamentally sound educational theory and practice be built up. Teaching is becoming more and more a highly specialized procedure. Before we can attempt to guide intelligently the development of the child we must have an adequate conception not only of the nature of children in general but of each particular child we are trying to guide. In education we cannot look upon a group of children as possessing certain abilities, interests and achievements, etc., but we must consider education as a problem concerned with the individual child. Probably no more important educational problem faces us than the one concerned with the adaptation of instruction to meet the needs of the individual child, his interests, his aptitudes, his socialization, etc. In order to do this we must know what these needs are, how they arose, and what changes are made in the individual when they are met. Because of differences among children there can be no one procedure in teaching, but there should be many procedures, each adapted to the individual for whom it is intended.

QUESTIONS AND EXERCISES

1. Why is a study of individual differences important for the teacher?
2. Do you think that educational influences should tend to lessen or increase individual differences? Why?
3. Are there some school subjects in which the abilities of pupils should be made more alike and others in which they should be made more unlike?
4. Can you offer an explanation of the Law of Filial Regression?
5. Find the middle score for each grade in Table I. How do these compare with the norms?
6. From inspection, rank the grades in Table I according to variability of grades shown.
7. Secure three dice and throw the three together 216 times, keeping a record of the total number of spots turned up at each throw. Since there are from 1 to 6 spots

on the sides of the dice, it is possible to have a total of 18 points when the side of each of the dice with 6 spots is up. Likewise, a total of three points may be secured.

8. Plot a normal probability curve showing the results secured in No. 7. Let the base line represent the number of points thrown. The lowest number of points, 3, should be at the left and 18 at the right. Let the vertical line represent the number of times a total was thrown.

9. If all differences between pupils of the same sex at a given age were due to environmental differences, how would this influence the work of the school?

10. Suppose just the opposite condition true, how would the work of the teacher be modified?

11. Visit a classroom and observe during a class period the apparent differences in ability of the children.

SELECTED REFERENCES

1. Dearborn, W. F. *Intelligence Tests*, Chap. II. Houghton Mifflin Company. 1928.
2. Ellis, R. S. *The Psychology of Individual Differences*, Chaps. I, V, VII, and VIII. D. Appleton and Company. 1928.
3. Freeman, F. N. *Mental Tests*, Chaps. I and II. Houghton Mifflin Company. 1926.
4. Garrison, S. C. "Variation within the Grammar Grades." George Peabody College for Teachers, *Contributions to Education*, No. 8. 1922.
5. Jones, A. J. *Education and the Individual*, Chaps. VI and X. The Century Co. 1926.
6. Mort, P. R. *The Individual Pupil*, Chap. I. American Book Company. 1928.

7. Peterson, Joseph. *Early Conceptions and Tests of Intelligence*, Chaps. I, II, and III. World Book Company. 1926.
8. Reavis, W. C. *Pupil Adjustment in Junior and Senior High Schools*, Part I. D. C. Heath and Company. 1926.
9. Yule, G. U. *An Introduction to the Theory of Statistics*, Chap. VIII. Charles Griffin and Company, Ltd., London. 1917.

CHAPTER II

CAUSES OF INDIVIDUAL DIFFERENCES

Until comparatively recent years the theory that a trait acquired by the parent might be passed on to the offspring was generally accepted. Darwin's theory of pangenesis, which was really the first important one dealing with the problem, held that the body cells give off minute particles which he called *gemmules* or *pangens*. These he thought are brought together and form the reproductive cells. Since these particles come from the various parts of the body, as he thought, the offspring might develop like the parent. Galton first questioned the inheritance of acquired differences and Weismann later (1883) gave the theory of the continuity of germ plasm. According to this theory there are two kinds of cells, body cells and germ cells. Body cells grow out of germ cells. Weismann emphasized the independence of the germ cells from bodily influences. Mendel, through his study of the garden pea, gave a notion of how traits are inherited. The work of Galton, Weismann, Mendel, and others gave a view of the organism which probably overemphasized heredity as a factor in the development of differences. In the main, however, their theories and experiments have been confirmed by later workers.

The various factors making for individual differences may be grouped under two headings, *biological* *heredity* and *social heredity*, or heredity and environment. These in turn may be subdivided. The interests and purposes of the student will determine the subheadings. For our purposes the hereditary factors may be grouped under race, family, sex, and probably maturity. The environmental factors may be grouped in many ways. We have grouped these under prenatal and postnatal. The postnatal factors are further grouped under the topics (*a*) directed or organized agencies making for differences in development and (*b*) undirected or unorganized agencies making for differences. Sometimes the factors are grouped under three headings instead of two. These are generally given as heredity, environment, and training. We believe that a scheme which views training as the directed or controlled part of one's postnatal environment is to be preferred.

THE CONCEPT OF HEREDITY

It is universally observed that in general the old statement, "like begets like," is true. Heredity must not be thought of as any sort of mystical entity or force or power influencing the individual. At the union of the sperm and egg cells the individual and its heredity must be considered one and the same. In later life the individual may be thought of as the realization of hereditary potentialities in a given environment. At the beginning of its life, however, it is nothing more than these potentialities. As we study individuals we are impressed with two facts: first, there is usually very great resemblance between parent and offspring; and second, there are also very frequently wide differences in the degree of this resemblance. On first thought these wide differences or variations appear to be opposed to the concept of heredity. However, these variations are either acquired or inherited; if acquired, they are not in conflict with the notion of heredity. It must be remembered that not all the potential traits in the fertilized egg are developed in the individual but may be passed on to the offspring, where they may in turn develop, thus causing the progeny to differ in the particular trait from the parent.

Racial differences. We frequently apply to the various races adjectives which imply differences. Thus we speak of the emotional Frenchman, the sturdy Englishman, the energetic American, and the cunning Indian. How far these character traits are a result of heredity is a matter of doubt. It may be possible that environmental factors largely determine character traits. In the present condition of science we are unable to tell. When educational and mental measurements are made, we find in some cases what appear to be significant differences. We may cite some of the newer major studies dealing with the subject. Peterson,[1] in probably the best study yet made of differences between negroes and whites, made the following statement, basing it on data derived through the use of his Rational Learning Test:

---

[1] Peterson, J. "The Comparative Abilities of White and Negro Children," *Comparative Psychology Monograph*, Vol. I, Serial Number 5, pp. 118, 119. The Williams & Wilkins Company, Baltimore, Md. July, 1923.

> From every standpoint, then, so far as our criteria in this test are concerned, the white children are markedly superior to the negro children, particularly in functions such as sustained attention to the essential elements of a complex situation to be mastered, functions which are essential in a high degree to success in the modern world. Indeed, taking all the criteria of the test together we find the 8-year-old white children to be considerably superior to the 10-year-old negro children.

This writer further states that 60 per cent of the whites tested are from the poorest white schools while 97 per cent of the 10-year-old negroes are from the negro schools judged to have the best native ability. He cautions against the fallacy of applying his results in the gross. If the negro as a rule is inferior to the white, it must be remembered that here we are thinking in terms of averages. Many negroes, as Peterson points out, are capable, as measured by the test, of doing work in institutions of higher learning. It is as important that the facts of variation be considered in educating negro children as in educating white children. As compared with the whites, the negro seems to have fewer potential leaders. If a much larger proportion of negro children than white children are unable to profit by the curriculum generally given in the elementary grades, then it is so much the more imperative in educating negro

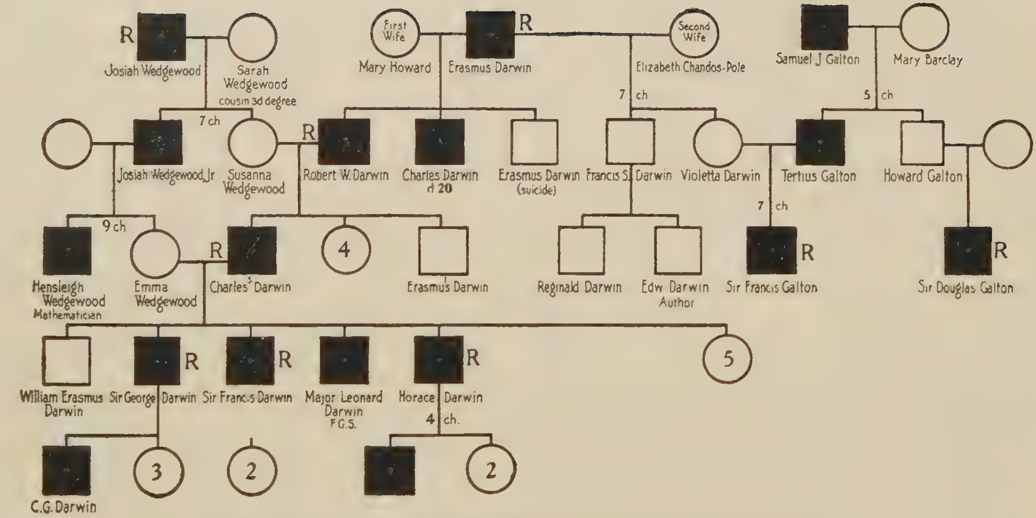


Figure 2. The Darwin-Wedgewood-Galton Family

Males of note, black squares; an R beside square shows membership in one of the Royal Societies. Figures in circles show number of daughters if more than one.

children to make modifications in the curriculum to suit the negro child's ability.

Garth,[1] who has contributed much to the study of differences due to race, summarized existing studies by stating, "These studies taken all together seem to indicate the superiority of the white race." Writers generally agree that there are persons of almost all races who possess abilities of high order. The relative number of persons of very low or very high mental ability in each race is probably the most important question yet to be answered in this connection.

Differences due to family. Everyone recognizes differences due to race, but aside from the general racial characteristics there are also differences due to family. A number of more general studies have been made showing inferiority or superiority in general mental ability. The Kallikak family, the Jukes, the Winns, and others are frequently cited to show how feeble-mindedness has been inherited. On the opposite side can be placed the Edwards family, the Darwin-Wedgewood-Galton family, and others to show how great endowment tends to be transmitted from parent to child. In these studies heredity is undoubtedly a very important factor. Figure 2[2] gives the Darwin-Wedgewood-Galton family. The black squares represent men of marked ability. The Bach family is another well-known example of the inheritance of family traits. In six generations of this family there were produced 57 outstanding musicians, of whom 29 were really famous. In studying the inheritance of family traits it should be noted that heredity is always first a question of structure or physiological condition. The inheritance of great mental ability or of musical ability really means the inheritance of a physical basis which makes possible a functionally superior organism.

---

[1] Garth, T. R. "A Review of Racial Psychology," *Psychological Bulletin*, Vol. 22, No. 6, p. 359. June, 1925.

[2] Downing, E. R. *Elementary Eugenics.* University of Chicago Press. 1929, facing p. 7.

When one speaks of family traits he does not mean that an individual gets all or even a majority of his traits from any one ancestor. The children of the same parents are not totally alike, yet in most cases the resemblance is so great that a keen observer can pick out relatives in a group of persons composed of relatives and non-relatives. There are varying degrees of resemblance in mental and physical traits between members of the same family. Some individuals apparently have received traits from more remote ancestors, while other members of the family show traits from the more immediate ones.

Sex differences. The great mass of experimental evidence of recent years seems to establish firmly the idea that sex is a fact of heredity and not a result of environment. The egg cell given off by the female of the human species contains 24 *chromosomes*. These chromosomes, or thread-like processes in the egg, seem to be the carriers of the hereditary traits. The sperm cells from the male are of two kinds, one contains 23 chromosomes while the other contains an extra one known as the X-chromosome, thus making 24. Approximately one half of the sperm cells is of either kind. When an egg cell is fertilized by a sperm cell containing 24 chromosomes, the resulting offspring will be a female; if the egg is fertilized by one containing 23 the offspring will be a male. Maleness and femaleness are then determined at the time of fertilization and predetermined by the heredity of the individual. No one of course has ever observed the union of human germ cells and the development of the resulting individual. The process of fertilization and development in higher forms is largely inferred from similar processes in the lower.

There is no doubt that many of the differences we find in boys and girls have a physical basis in heredity. However, one must be cautious in assuming that all differences found between the sexes are due to this physical basis. It must be remembered that to a certain extent at least society has made a different environment for boys and girls. This problem will be discussed in a later paragraph.

There are several other lines of evidence which seem to show that sex is determined in the fertilized egg. There seem to be two kinds of twins. Twins coming from different eggs are no more alike on the average than are two others of the offspring of the same parents. They may be of the same or of different sex. True twins come from the same fertilized egg, are always of the same sex, and resemble each other very closely. True twins are a result of the separation of the two daughter cells at the time of the first division of the fertilized egg. Probably such differences as are found between true twins in later life may be thought of as the result of differences due to environment. Again, there is the familiar example of the queen bee whose unfertilized eggs develop into drones while the fertilized ones develop into normal females (queens) and workers, depending on environmental conditions.

In early embryonic life human males and females cannot be differentiated by external form. By birth, however, sex differences have become more pronounced and the sexes can be differentiated by certain qualities and external organs. If the inherited sex structures (glands) are removed through design or disease, the individual tends to develop secondary sex traits similar to those possessed by the opposite sex. It is very hard to disentangle hereditary from environmental influences. Many of the so-called sex differences are undoubtedly the result of early training.

Measurements of physiological development probably show hereditary differences. It is a common observation that girls mature earlier than boys. Baldwin,[1] in his extensive study of Iowa children, reaches the following conclusions with respect to sex differences:

---

[1] Baldwin, B. T. "The Physical Growth of Children from Birth to Maturity," University of Iowa *Studies in Child Welfare*, Vol. I, No. 1, pp. 69, 92, 94, 151, 164. June 1, 1921.

1. The growth curves for height and weight of boys and girls are similar from birth to six years of age. The boys are slightly superior in both traits during this period.
2. With boys and girls the stature curve shows a railroad appearance with relatively little crossing but a tendency to fan out at adolescence.
3. Girls show inferior development in breathing capacity to boys at all ages.
4. Girls reach the period of cessation of growth before boys.
5. Girls are inferior to boys in all strength tests.
6. Girls are taller than boys from 10 to 14 years of age.
7. Girls are heavier than boys from 9 to 16 years of age.
8. There is a closer correlation between the various physical measurements for boys than for girls.
9. Girls at seven years of age have reached a stage of development considerably in advance of that of boys, and girls continue to lead in all phases of growth, so that a 12-year-old girl is as far advanced toward her final growth at 17 as a 14-year-old boy.

Pryor [1] worked out a comparison of the sexes on the basis of the ossification of the bones of the wrist. He used this as a measure of anatomical age. His results are given in Table V. Probably the most significant fact in the table is the increasing difference. It will be noticed that there is a rather decided difference at the time of pubescence — between 10.3 and 12.6.

---

[1] Quoted by Woodrow, Herbert. *Brightness and Dullness in Children,* p. 112. J. B. Lippincott Company. 1919.

Table V. Sex Differences in Anatomical Age as Measured by Ossification of the Wrist Bones

Girl's Age	Anatomically Equivalent Boy's Age	Difference
1 yr. 6 mo.	2 yr. 0 mo.	6 mo.
2 yr. 6 mo.	3 yr. 3 mo.	9 mo.
3 yr. 6 mo.	4 yr. 3 mo.	9 mo.
4 yr. 9 mo.	5 yr. 9 mo.	12 mo.
6 yr. 3 mo.	7 yr. 3 mo.	12 mo.
7 yr. 6 mo.	9 yr. 0 mo.	18 mo.
8 yr. 6 mo.	10 yr. 0 mo.	18 mo.
10 yr. 3 mo.	12 yr. 9 mo.	30 mo.
12 yr. 6 mo.	15 yr. 0 mo.	30 mo.

Woolley,[1] who has herself done much work in this field, summarizes the mass of experimental data which has accumulated as follows:

> The feminine sex usually appears to be somewhat superior in immediate memory, in coördination tests such as card-sorting, cancellation, and substitution, and in tests in which logical verbal associations are the chief requirement, such as association by opposites, cause and effect, and hand directions. The male sex has been found to be very superior in tests of logical thinking in which manipulation of objects is required, such as construction puzzles and puzzle boxes. In tests of logical memory and report, sex differences have been small and contradictory. The sex differences are most of them very small in comparison with differences found between the superior and inferior members of the same sex.

---

[1] Woolley, Helen Thompson. *An Experimental Study of Children*, p. 513. By permission of The Macmillan Company, publishers.

No general rule of treatment can be stated with regard to sex differences. For any trait measured, a large per cent of one sex will be found who possess the median ability of the other. Except probably in some phases of physical education sex differences do not constitute the real educational problem. In many traits the differences between boy and boy and girl and girl are in many cases greater than the differences between boys and girls. As someone has aptly said, the most important characteristic of the difference between the sexes is its smallness.

A problem which has more than academic interest is the question of variability within each of the sexes. Are boys more variable than girls or is the opposite true? Or is this variability the same? The hypothesis that boys are more variable than girls has frequently been stated. In support of this hypothesis has been quoted the facts that (1) more boys are born than girls, almost 106 to 100; (2) the death rate is higher for them early in life; (3) more boys are feeble-minded than girls; (4) more are color blind; etc. Terman,[1] in studying children of high intelligence, found his data bearing on this problem somewhat inconsistent. His three highest scores were made by girls, but of the gifted children discovered in his survey for talent he found approximately 135 boys to 100 girls. In another part of the study dealing with 309 gifted high school students who had been selected on the basis of the Terman Group Test scores he found the sex ratio to be 183 boys to 100 girls. Terman suggests that the proportion of high-scoring girls may decrease as adulthood is approached.

---

[1] Terman, L. M. *Genetic Studies of Genius*, Vol. I, Chap. III. Stanford University Press. 1925.

Woolley states in her study of children that no consistent sex differences in variability can be shown, either in physical or mental traits.

Maturity and individual differences. It would probably be agreed that, apart from training, mere physiological growth or development of the individual would cause a difference in ability. Just what part maturity plays in development we are unable to state because of the fact that we do not yet have any way of measuring growth changes apart from environmental influences. Probably consecutive measurements of an individual on a scale made up of the tests which all individuals of a given age have approximately equal opportunities to learn is as accurate a measure of maturity as we can find at the present stage of development of the science of psychology. The studies dealing with the subject seem to show that a person who possesses a certain degree of brightness early in life will likely have about the same degree later in life. In other words, maturity merely means additional growth along lines already established and at about the same rate. Thus, when measurements are taken of strength, grip, memory for nonsense syllables, degree of brightness, etc., the individual tends to hold the same relative rank in later measurements that he held in early ones. Undoubtedly, however, environmental factors influence our measurements.

The importance of determining what differences are due to heredity lies in the fact that they are the starting point for individual training. Also these differences determine in a large measure our point of view with respect to the training of the individual. If a pupil is poor in arithmetic because of lack of native ability, the problem is of one nature; if this weakness is due to an acquired dislike, the problem is one of an entirely different nature.

THE CONCEPT OF ENVIRONMENT

The older sciences may be classified as either biological or physical. The biological sciences have been concerned largely with a study of the living things themselves, their origin, classification, structure, etc. The physical sciences on the other hand have been concerned somewhat with similar problems. Between these two fields there lies a bit of territory, so to speak, which is just being occupied by newer studies, the so-called social sciences. The concept "heredity" has been pretty well developed by workers in the biological sciences and the innate factors of development fairly well analyzed. The concept "environment" is in need of as definite analysis as that of heredity. With the development of the social sciences we may expect many studies, in addition to those already made, devoted to the clarification of the meaning of the term environment. The environment of an individual may be thought of as made up of all the things, persons, other living things, experiences, traditions and customs, relationships, mental concepts, etc., which may influence behavior. Environment cannot be thought of as a static set of conditions. In the real sense of the word environment can only be used in connection with living things.

The environment is changed by the individual and in being changed causes changes in the individual. The individual is constantly changing because of internal as well as external conditions in the environment. Strictly speaking, the individual cannot be separated from the environment because it develops in, and because of, its environment. No one can say definitely where the environment begins and the individual ends. The individual may be conceived of as heredity plus environment; that is, the development of the hereditary potentialities present in the fertilized egg as reactions are made to environmental and internal changes. Child,[1] in speaking of the development of pattern in organisms, makes the following statement:

> Organismic pattern has reference at every point to the relations between protoplasms and environment. The organism as a pattern, a mechanism, has no meaning except in relation to environment. It is in fact a pattern which makes it possible first of all for protoplasm to persist in the external world, and second to modify and control its environment to an increasing degree. In whatever aspect

---

[1] Child, C. M. *Physiological Foundations of Behavior*, p. 9. Henry Holt and Company. 1924.

we regard the organism, it is obviously in relation to environment at every point.

Clearly a good heredity means inherent potentialities which will develop into desirable patterns or reaction systems (instincts, habits, etc.) if the right kind of stimulation is furnished by the environment. It is equally obvious that a good environment is one which furnishes stimulation that causes changes in the behavior patterns of the organism which make possible further adaptations of a desirable kind.

In thinking of inherent potentialities we must not think of definite fixed amounts except in relation to the same particular environment. If it were possible to furnish a number of children the same environment from birth to adulthood, then we might find a rather reliable measure which would rate the individuals in terms of the amount of the trait each possessed because of heredity. Of course we can never hope to give any number of children the same environment because the environment itself depends on inherent activities. The environment can never be the same for two children one of whom has inherited talent in music while the other has not.

In studying differences between children it is necessary to note that there are two varying factors affecting development, the environmental and the hereditary. The heredity of individuals in general varies all the way from that which under proper stimulation develops into the great genius to that which develops into the person barely able to adjust himself to the simplest types of environment; barely able to live would very likely be a better description. Probably many individuals of the latter type do not survive prenatal life. On the other hand, the environment varies all the way from that which furnishes stimulation making for great genius to that which barely provides for growth produced by the interaction of these two factors. Heredity A plus environment X will produce an individual quite different from heredity A plus environment Y. In like manner, heredity B plus environment X will produce an individual different from heredity A plus environment X. In other words, we must think of individuals varying not only in hereditary potentialities but also in environmental potentialities for stimulation to growth and development. We do not of course measure either the hereditary or environmental factors but the reactions of the individual produced by these two factors.

Environmental influences on prenatal development. It has already been noted that hereditary and environmental factors are complementary in the process of development, as there would be no development, no organism if the proper environmental factors were not present. Indeed, the process of fertilization itself depends on environmental stimuli. By the elimination or modification of these stimuli which are generally found in the environment of the organism, abnormal individuals are frequently formed: Dwarfs, giants, Siamese twins, two-headed, one-eyed, and many other sorts of abnormal embryos have been produced. Defective and inferior individuals may be considered as due to abnormal environmental conditions as well as to defective heredity. Investigations[1] have shown that toxins of various sorts, poisons, alcohol, unusual conditions of humidity, X-rays, reversal of the position of the embryo, and many other agents produce abnormal development in the embryo. This, however, does not mean the inheritance of acquired characters. The germ plasm is part of the parent and functions as such. At this time alcoholism, syphilis, and other abnormal conditions might so weaken the germ cells as to produce permanent results. The same is true of injury at birth, which is also clearly a case of environment.

Modern studies have tended to emphasize the oneness or unity of the organism. We no longer consider the individual as composed of a number of faculties. We think of the organism as functioning in various ways. To some of these characteristic ways of behaving we have applied names. Thus we speak of memory, imagination, physical activity, mental activity, and numerous other kinds of activities but always we think of the organism functioning as a unit. When we speak of mental activity, we do not forget that it is the organism which is active. Mentality means the functioning of the organism in certain ways. Mental activity might be spoken of as a type of physical activity. Obviously anything which tends to destroy or weaken the organism influences its ability to function.

---

[1] The literature is summarized in Feldman, W. M. *Ante-Natal and Post-Natal Child Physiology*, Chap. VII. Longmans, Green and Company, London. 1920.

Environmental influences on postnatal development. These influences might be considered in many ways. The purpose a writer has in view will largely determine how the subject is to be treated. The subject might be studied from the viewpoint of (*a*) physical development and (*b*) mental development. This would, however, hardly be a scientific way of attacking the problem since it is only by a pure fiction of the imagination that the two can be separated. Any influence which would make for one type of development would make for the other also. Here again we are faced with the fact that we are dealing with one organism which behaves in many ways.

As stated previously, the factors influencing postnatal development have been frequently stated as environment and as training. We feel that the above way of stating the problem is misleading in that training is certainly a part of environment. Probably a better statement would be one in which environment is thought of as made up of factors which we do not definitely try to control and those which we attempt to organize for purposes of control. The object of the latter is to furnish means of causing growth of a kind we have agreed upon previously. We certainly do not mean to imply that influences in the environment which are not definitely organized and studied do not produce definite results. The implication is that the results cannot be predicted, not that they do not obey the laws of cause and effect, but that no attempt is made to use them for a definite purpose. Society is slowly but surely getting a better and better grasp on the factors and processes which make for desirable growth. That is, more and more are we understanding and utilizing additional environmental influences in a desirable way.

Vocational guidance or the lack of vocational guidance might be used to illustrate environmental influences. Many a person goes through school with no kind of direction toward a definite calling in life. When such a person finishes school, he begins to look about for something to do. The line of work he will follow is determined by what openings are available for a person of his particular training, age, sex, etc., and what the conditions are which make it desirable that he work at something. On the other hand, a person who has been definitely prepared for a certain line of work through guidance will immediately begin looking for the type of work toward which he has been directed.

Relation between physical and mental traits. There is a great amount of research being done at the present time with respect to the topic treated here. Baldwin, Terman, Gates, Dearborn, and others are devoting a considerable amount of time to the problem. Baldwin [1] has probably devoted as much effort to a solution of the problem as anyone. He says:

---

[1] Baldwin, B. T. In *The Child, His Nature and His Needs*, p. 22. The Children's Foundation. Valparaiso, Ind. 1924.

The dependence of health upon physical well-being, the large percentage of physically defective children in our public schools, the relation between physical growth and school progress, and the relation between mental and physical development, all point to the need of widespread information in regard to physical growth and development of school children. A knowledge of a child's stage of physical development is an important factor in placing him in the grade where he can do his best work, in prescribing the amount of school work he should be expected to do, in promoting him, in providing suitable schoolroom equipment, in directing his physical training and choice of games and sports, and in interpreting his stage of social maturity.

In another study, Baldwin,[1] basing his conclusions on the advent of pubescence, states that in his judgment physiological age (as measured by maturity) is directly correlated with mental maturation. He further states that "physiological age" has a direct bearing on "pedagogical age." Most of the correlations between purely physical measurements, as height and weight, with measurements of mental ability have given rather low measures of relationship. The writers feel that height and weight are to a large extent due to inherited factors which may be relatively independent of inherited factors making for vitality or mental ability. Too frequently we gather data on the height and weight of school children and interpret the data in the light of certain assumptions which are not based on experimental findings. At present we do not know what relationship should exist between height and weight. Sometimes the procedure is followed of calling all children normal who do not deviate more than so many pounds from the normal for a given age. Such procedure is at present based on opinion only, and too great importance must not be attached to it. Woolley,[1] after an intensive experimental study, makes the following statement:

---

[1] Baldwin, B. T. "The Physical Growth of Children from Birth to Maturity," Vol. I, No. 1, pp. 196, 197. University of Iowa *Studies in Child Welfare.* June, 1921.

> Some enthusiastic nutrition workers, for instance, have been inclined to assume that the small children were undernourished and that the school retardation was the result of the undernourishment. Improve the nutrition of the child, they argue, and the school retardation will be retrieved. It seems more probable that mental superiority and physical superiority tend to occur in the same organism than that either one is directly the cause of the other. We have a general faith that both physical and mental conditions are well worth improving for their own sakes, and furthermore that an improvement in one tends to react favorably on the other. As yet, however, we have no very accurate notion of the extent to which mental ills can be cured by improving physical conditions or physical ills cured by improving mental conditions.

The weight-height-age index is important in the classification of children and should be considered together with mental ability and other factors, but not used alone. In schools, students are found possessing physical and mental traits in varying degrees. Large children with inferior mental ability probably should be guided into lines leading into work involving physical activity at a fairly early age. Care must be taken that the child small physically but superior mentally secures the proper social environment. The danger here is that physical activities will be neglected. The child who is accelerated physically and mentally probably should go through school faster than one who is average or inferior physically but superior mentally. The oneness or unity of the individual should never be lost sight of. Situations must be created for the particular child under consideration in the light of his physical and mental make-up. The question to be considered in school as well as out is: Are we creating the best situation possible for this child?

---

[1] Woolley, Helen Thompson. *An Experimental Study of Children*, pp. 549–550. 1926. By permission of The Macmillan Company, publishers.

Why it is important to measure differences in children. Quantitative studies have become more numerous in the field of education in recent years. Workers recognize that questions can be settled in a definite way only when they are submitted to experimental conditions and the results treated by objective methods. At present there are many problems relating to teaching concerning which only an opinion can be given. However, as new techniques are devised and opportunities provided for investigation, opinion is more and more giving way to known facts. The process of training a child is too important to leave to a method based on opinions and guesses. What traits a child should possess at a given age, what changes should be made, what are the best methods of modifying old traits and building new ones are questions to which experimental methods can be applied and the results treated in a mathematical way.

QUESTIONS AND EXERCISES

1. Write out a statement of heredity as you understand the meaning of the term.
2. List ten traits that are a result of biological inheritance.
3. List ten traits that are acquired from the social heredity.
4. List five traits that are due to racial heredity.
5. List five traits that are due to family.
6. List ways in which sex differences are important for the school.
7. Why is it important to know which differences are due to heredity and which to environment?
8. Study the environment of two children, listing similarities and dissimilarities.
9. What do we mean when we speak of children coming from a good section of a city and children coming from a poor section? What are the implications of such a statement?
10. What is meant by the statement, "The inheritance of great mental ability or of musical ability really means the inheritance of a physical basis which makes possible a functionally superior organism"? State the thought in your own words.
11. Visit a fifth grade, if possible, and ask the teacher to name the ten best pupils and the ten poorest. Do you find any differences which might be due to sex? If girls

mature faster than boys, what do you expect to find when you study the achievement of, say, boys and girls twelve years of age?

12. The term "good environment" is used frequently. Can you state what is meant by the term? Would the same school environment be equally good for two children? What determines whether an environment is good or bad?

SELECTED REFERENCES

1. Baldwin, B. T. "The Physical Growth of Children from Birth to Maturity," Vol. I, No. 1. University of Iowa *Studies in Child Welfare*. 1921.
2. Cameron, E. H. *Psychology of the School*, Chap. XIV. The Century Co. 1921.
3. Castle, W. E. *Genetics and Eugenics*. Harvard University Press. 1916.
4. Child, C. M. *Physiological Foundations of Behavior*. Henry Holt and Company. 1924.
5. Conklin, Edwin G. *Heredity and Environment*. Princeton University Press. 1915.
6. Dugdale, R. L. · *The Jukes: A Study in Crime, Pauperism, Disease, and Heredity*. G. P. Putnam's Sons. 1877.
7. Downing, E. R. *Elementary Eugenics*. University of Chicago Press. 1929.
8. Garth, T. R. "Review of Racial Psychology," *Psychological Bulletin*, Vol. 22, No. 6. June, 1925.
9. Goddard, H. H. *Feeble-mindedness: Its Causes and Consequences*. The Macmillan Company. 1914.
10. Goddard, H. H. *The Kallikak Family; A Study in the Heredity of Feeble-mindedness*. The Macmillan Company. 1912.

11. Peterson, Joseph. *Early Conceptions and Tests of Intelligence.* World Book Company. 1925.
12. Peterson, Joseph. "The Comparative Abilities of White and Negro Children," *Comparative Psychology Monograph*, Vol. I, No. 5. 1923.
13. Starch, Daniel. *Educational Psychology*, Chaps. III–V. The Macmillan Company. 1919.
14. Strong, E. K. *Introductory Psychology for Teachers*, Lesson 24. Warwick & York, Inc. 1920.
15. Terman, L. M. *Genetic Studies of Genius.* Stanford University Press. 1925.
16. Terman, L. M. *Intelligence of School Children*, Chaps. III and IV. Houghton Mifflin Company. 1919.
17. Thorndike, E. L. *Educational Psychology*, Vol. III, Part II. Teachers College, Columbia University. 1914.
18. Walter, H. E. *Genetics.* The Macmillan Company. 1913.
19. Wilson, E. B. *The Cell in Development and Heredity.* The Macmillan Company. 1925.
20. Woodrow, Herbert. *Brightness and Dullness in Children.* J. B. Lippincott Company. 1919.
21. Woodruff, L. L. *Foundations of Biology*, pp. 236, 237. The Macmillan Company. 1922.
22. Woolley, Helen Thompson. *An Experimental Study of Children.* The Macmillan Company. 1926.

CHAPTER III

MEASUREMENTS

Origin of measurement in education. No definite date can be assigned to the origin of measurements of mental abilities and educational achievements. The most noteworthy developments have been made during comparatively recent years. Interest in individual differences developed during the latter half of the nineteenth century, but it was necessary to develop scientific technique before fruitful work was possible. As stated in a previous chapter, the work of Galton in England and that of Binet in France were united in America largely through the influence of Cattell and his students.

Dr. J. M. Rice in 1894–1895 made his first investigation in the subject of spelling. This was the first attempt in America to study on a large scale the results of teaching by means of a test. Later, Rice studied through the use of tests the results of instruction in language and arithmetic.

Perhaps Dr. E. L. Thorndike has contributed more than any other one individual to experimental and quantitative studies in the field of education. As early as 1903 he began his investigation of abilities through objective and quantitative methods. In 1904 the first edition of his book, *Mental and Social Measurements*, was published. Later, this book was revised and for a long period of time was practically the only text in the field. Probably no other text has had so much influence in the development of the scientific point of view in education. Thorndike's Handwriting Scale was published in 1909. In its standardization he made use of methods developed by Cattell and later used by Hillegas in the construction of the Hillegas Composition Scale (1912). This was the first scientific instrument for measuring ability in English composition.

C. W. Stone (1908) and S. A. Courtis (1909) constructed arithmetic tests and studied the results of instruction in arithmetic. Some of these tests were afterwards standardized and exerted a great influence on later test construction. The Courtis Research Arithmetic Tests Series B have been very widely used.

Dr. Leonard P. Ayres constructed a handwriting scale in 1912 and a spelling scale in 1915. The spelling scale especially has been widely used and has exerted a profound influence on the spelling curriculum. The words of the scale have been used as spelling lists.

The spelling scale constructed by Dr. B. R. Buckingham in 1913, while not widely used, represented an advance in standardization. In this study the difficulty of the words was determined in terms of the per cent of correct spellings. The method used here is largely due to the work of Karl Pearson and has been followed by most research workers of recent years. Many other research workers too numerous to mention have contributed to educational

GODDARD'S RECORD BLANK FOR REVISED BINET TEST

Name **Sex** **Examined**

School Grade **Actual Age** **Mental Age**

III

1 Points to nose, eyes, mouth
2 Repeats "It rains. I am hungry."
3 Repeats 7 2
4 Sees in picture 1. 4.
2. 5.
3. 6.
5 Knows name

IV

1 Knows sex, boy or girl (girl or boy)
2 Recognizes key, knife, penny
3 Repeats 7 4 8
4 Compares lines

V

1 Compares 3 and 12 grams. 6 and 15 grams
2 Copies square. (Draw on back of this sheet)
3 Repeats, "His name is John. He is a very good boy."
4 Counts four pennies
5 "Patience"

VI

1 Morning or afternoon. (afternoon or morning)
2 Defines fork horse
table mama
chair
3 Puts key on chair; shuts door; brings box
4 Shows R. Hand. L. Ear
5 Chooses prettier? 1 & 2, 4 & 3, 5 & 6

VII

1 Counts 13 pennies
2 Describes. (See III 4)
3 Sees picture lacks eyes, nose, mouth, arms
4 Copies diamond. (over)
5 Recognizes red, blue, green, yellow (Time 6″)

VIII

1 Compares (Time 20″)
Butterfly Wood Paper
Fly Glass Cloth
2 Counts backward 20–1. (Time 20″)
3 Repeats days. M. T. W. T. F. S. S. (Time 10″)
4 Counts stamps. 111222. (Time 10″)
5 Repeats 4 7 3 9 5

IX

1 Makes changes 20c—4c
2 Definitions (See VI 2)
3 Knows date
4 Months. J. F. M. A. M. J. J. A. S. O. N. D. (Time 15″)
5 Arranges weights. (2 correct) (1 min. each) 1. 2. 3.

---

measurements. Their studies fill the educational and psychological journals of today.

Mental measurements, like educational measurements, grew out of the work of a small group of psychologists: Galton, Binet, Cattell, Terman, and others. As early as 1890–1900 Binet was experimenting with tests. In 1905 he and Simon devised the Binet-Simon General Intelligence Tests. Binet revised these tests in 1908, and again in 1911. Goddard, at Vineland, N. J., published his revision of the Binet-Simon Scale in 1910. The Binet-Simon Scale has been revised by three other American psychologists: Kuhlmann, 1912; Terman, 1913;

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE

Herring, 1922. The idea of mental age and intelligence quotient was developed in connection with the Binet-Simon Scale. An illustration of the Goddard Revision[1] of the Binet-Simon Scale is given on pages 44 and 45, where the first page of the scale is reproduced.

Group intelligence tests are a later development than the Binet-Simon. The Army Alpha was developed for uses in the World War. Over 1,700,000 men were given this test during the war. Dr. A. S. Otis devised and published the Otis Group Intelligence Tests, which did not appear in print until after the war. Much of the credit for the Army Alpha is due Doctor Otis, who generously placed his material in the hands of those who constructed the Army Alpha. A committee of psychologists developed the National Intelligence Test, which has been used very widely. Over a half million copies of this test were sold during the first year of its existence.

The meaning of mental age. As stated in the preceding paragraph, the concept "mental age" was developed by Binet in connection with the Binet-Simon Scale. This term was originally used with reference to children under fourteen years of age but lately with respect to measurements made on persons several years older as well. A given mental age refers to the average mental ability of children of that particular chronological age. Thus, a child possessing a mental age of ten is supposed to possess the mental ability usually possessed by children ten years of age. The child may be younger or older but the comparison is made with children possessing the same mental ability. That is, the child with a mental age of ten is able to do as much on a standardized test as the average child ten years of age.

---

[1] Goddard, H. H. "The Binet-Simon Measuring Scale for Intelligence," *The Training School*, Vol. VI, pp. 146–154. 1910.

The meaning of intelligence quotient. Intelligence quotient is a term which is used to express the relation between a child's chronological age and his mental age as found by some test, usually the Binet-Simon. This quotient is found by dividing the mental age by the chronological age. Thus, a child whose chronological age is ten and who has a mental age of twelve has an intelligence quotient (I.Q.) of 1.20. One with a mental age of ten and a chronological age of twelve has an I.Q. of .83. In practice these quotients are expressed as whole numbers, as 120, 83.

This quotient is supposed to be a rather constant measure. If a group of children are tested year after year, the average I.Q. for the group will remain practically constant. However, sometimes there are rather wide variations found for individual children; the median variation being about 5 points.[1] Table VI shows the I.Q.'s of a number of children who were tested seven times at intervals of one year. It will be noticed that children with high I.Q.'s seem on the average to gain while children with low I.Q.'s do just the opposite.

---

[1] Garrison, S. C. "Additional Re-tests by Means of the Stanford Revision of the Binet-Simon Test," *Journal of Educational Psychology*, Vol. XIII, No. 5, pp. 307–312. 1922.

Table VI. Showing I.Q.'s Secured by the Use of the Stanford Revision of the Binet-Simon Test for the Pupils Who Were Tested Seven Times at an Interval of One Year between Testings

Pupil	I.Q.'s						
1	102	108	99	104	107	109	111
2	104	105	109	111	109	114	114
3	107	98	90	90	87	90	84
4	113	113	117	116	121	119	124
5	109	111	109	114	115	114	119
6	90	90	87	86	82	83	81
7	95	93	93	94	90	90	85
8	100	100	104	102	104	107	108
9	98	98	92	94	93	90	91
10	112	117	124	121	123	120	126
11	102	107	104	96	102	107	111
12	101	108	102	99	97	104	106
13	149	148	156	163	164	167	171
14	96	92	95	94	94	92	88
15	95	92	88	91	94	90	90
16	97	99	105	104	96	98	102
17	116	118	121	104	118	127	122
18	111	106	105	109	107	111	109
19	100	110	117	106	121	118	119
20	94	96	99	92	104	110	117
21	136	140	143	154	157	161	155
22	117	114	132	119	141	122	131
23	137	137	147	155	162	167	164
24	98	97	96	90	94	90	87
25	105	108	100	107	102	110	101
26	124	121	133	132	127	139	141
27	114	116	120	122	131	124	122
28	114	111	123	136	127	120	125
29	119	112	116	112	121	114	127
30	111	115	110	119	124	118	127
31	100	102	107	100	98	114	108
32	118	115	127	121	126	132	125
33	108	100	104	116	111	107	103
34	121	127	128	131	142	143	136
35	100	107	101	104	109	103	106

(From unpublished materials, Jesup Psychological Laboratory. The pupils took the test in the first grade and yearly thereafter.)

As stated in another paragraph, intelligence tests measure innate ability by measuring how well children respond to environmental influences. It has been assumed that the innate ability of an individual remains constant throughout life. In studying an individual it is necessary always to remember that the individual is more than heredity. It is a unitary pattern in protoplasm which is a result of hereditary ways of acting plus acquired ways. The individual is to be regarded not as a product of heredity alone and not as a product of environment alone but as a pattern which is organized by its own responses. These responses are of course conditioned by its heredity and by its environment. Intelligence, then, as we measure it has reference to this pattern.

Since the I.Q. remains relatively constant, the question might be raised as to why it remains so. The answer would seem to lie in the fact that one's hereditary make-up cannot be changed plus the additional fact, which is generally overlooked, that most children grow up in about the same environment as that in which they were born. What we are really measuring when we measure intelligence from year to year, as in Table VI, is the ability of the individual to function in a given environment. The ability of an individual so to function is a result of the patterns he has developed in a given environment which, for most persons, is a rather constant one from birth to maturity. That is, the constancy of the ability of an individual to function is probably a result of constancy of heredity plus approximate constancy of environmental factors. Our I.Q.'s, if they are constant, are undoubtedly so because of these facts. The writers know a few cases where children have been adopted or where home conditions have changed very materially. These cases, although few in number, seem to indicate a probability that the I.Q. is constant when no great change occurs in the environment.

The frequency of different degrees of intelligence as given by Terman[1] is shown in Table VII.

TABLE VII. SHOWING FREQUENCY OF DIFFERENT DEGREES OF INTELLIGENCE

The lowest	1%	go	to	70	or	below,	the highest	1%	reach	130	or above
The lowest	2%	go	to	73	or	below,	the highest	2%	reach	128	or above
The lowest	3%	go	to	76	or	below,	the highest	3%	reach	125	or above
The lowest	5%	go	to	78	or	below,	the highest	5%	reach	122	or above
The lowest	10%	go	to	85	or	below,	the highest	10%	reach	116	or above
The lowest	15%	go	to	88	or	below,	the highest	15%	reach	113	or above
The lowest	20%	go	to	91	or	below,	the highest	20%	reach	110	or above
The lowest	25%	go	to	92	or	below,	the highest	25%	reach	108	or above
The lowest	33%	go	to	95	or	below,	the highest	33%	reach	106	or above

The term intelligence quotient was at first used in reference to the Binet-Simon Scale only. Lately it has become customary to use this term and mental age in connection with group tests as well. Since the results secured by means of the different tests are not wholly comparable, it is best, in using the terms, always to state with what test the results were secured.

---

[1] Terman, L. M. *The Measurement of Intelligence*, p. 78, 1916. Used by permission of, and arrangement with, Houghton Mifflin Company.

The meaning of the accomplishment quotient. Dr. Raymond Franzen[1] devised the *achievement quotient.* This quotient is secured by dividing the achievement age by the mental age. By achievement age is meant the degree of achievement in the school subjects possessed by the average child of a like chronological age. There are various quotients in use. Sometimes the achievement quotient is found by dividing the achievement age by the chronological age. The reading age is sometimes divided by the actual age to find a reading quotient; the arithmetic age by the actual age to find an arithmetic quotient, and so on. It is seen that there is an almost endless variety of quotients. These sometimes serve a practical purpose but should not be used where exact results are required.

What is meant by norms? The use of measurements has been facilitated by the establishment of norms. Kelley[2] makes the following statement concerning the establishment of norms:

> At least four lines of development may be mentioned: the interpretation of scores or records (1) by referring to grade averages, (2) by referring to age standards, (3) by referring to percentile or deviation position in a definite group (usually an age or a grade group), and (4) by position determined by the variability of judgments of "competent judges."

---

[1] Franzen, Raymond. "The Accomplishment Quotient," *Teachers College Record.* Teachers College, Columbia University. November, 1920.

[2] Kelley, T. L. *Interpretation of Educational Measurements,* p. 12. Copyright, 1927 by World Book Company, Publishers, Yonkers-on-Hudson, New York.

Norms are generally expressed either in terms of the average accomplishment of children of a certain grade or average accomplishment of children of a certain age. Percentile norms are of advantage in that they furnish a method of determining a given child's position in a group. Percentile norms are illustrated in Table LXII, page 366.

What is a standardized test? There are hundreds of standardized tests on the market. The term is a general one and is used to include a great variety of tests. Standardized tests, however, are chiefly of two kinds, known respectively as tests and scales. The term test generally refers to a measuring device which is composed of items of approximately the same difficulty. The chief purpose of a test is to determine a pupil's rate of work or the number of test items he is able to do in a given time. A test measures pupil achievement in terms of amount accomplished. A scale, on the other hand, is composed of items of graded difficulties. The chief purpose here is to find the level of work which a pupil has achieved. The Woody Arithmetic Scales are composed of examples of graded difficulty. The steps between the examples are approximately equal. On the other hand, the Courtis Arithmetic Tests are composed of a number of examples of the same or nearly the same difficulty. Samples of these are shown in Chapter XXI, page 480."

Standardized tests are different from an examination given by the teacher in that a definite and objective technique is developed for their administration and scoring. Furthermore, norms are found which are based on a large and wide sampling of children. In this way norms are established so that it is known just what the average pupil for a given age or grade should do on the test. This is not true of the ordinary teachers' examination. By means of standard tests the achievement in one school system may be fairly compared with that in another.

Uses of standardized tests. In school work, tests are of use in a number of ways. The principal purposes for which they may be used are stated here. Each use would require a volume if adequately presented. In fact, volumes have been written concerning the use of tests, methods of handling data, etc.

1. For purposes of supervision
2. For purposes of diagnosis
3. For purposes of classification
4. For purposes of promotion
5. For purposes of comparing achievement in a grade or school system with that of another
6. For purposes of scientific study
7. For purposes of motivation and learning

Reliability and validity. Reliability refers to the extent to which one may depend upon a test to give the same results when administered the second time. Reliability thus refers to the accuracy of the measurement made regardless of what is measured. Will the same results be found if this test or a similar form of the test is used a second time? It may be admitted that an arithmetic test measures certain abilities in arithmetic. But does it give a reliable measure? Self-correlation is the test of reliability. Does the test when used a second time give results which correlate highly with those secured at the first testing?

Validity refers to the dependence which can be placed in a test to measure what it was designed to measure. It is obvious that reliability enters into validity for, if the test does not measure accurately what it is intended to measure, it can be neither valid nor reliable. The statistical technique for determining validity is well established. It is determined by its correlation with known valid measurements of the trait which the test is supposed to measure. Generally, a large number of measurements of the ability are made and these are assumed to be valid. The results of such measurements when combined may be correlated with the results of measurement secured by means of the test whose validity is in question.

Mental and educational tests. Many persons are under the impression that mental tests differ from educational in that they measure innate ability while the latter measure school achievement. This is a false distinction. Mental tests are constructed for the purpose of measuring the innate ability of individuals by measuring their achievement. There is of course no way of measuring the innate ability of an individual except in terms which show how he has learned to respond to the things in his environment. There are two criteria with reference to the environment which each mental test must satisfy, if it is to measure accurately the mental abilities of persons. First, the test must be composed of items which all individuals who are to be measured have had approximately equal environmental opportunities to learn. In the second place, it must be composed of a wide enough range of samples of the environment to be a reliable measure.

A mental test may be constructed for a wide range of children. In this case the test must be composed of items which all children have had a chance to learn. An examination of the Goddard Revision of the Binet-Simon Scale, page 44, shows that the scale is made up of a number of items which all children meet. On the other hand, a test may be constructed for a selected group of individuals, as college freshmen. In this case the test elements must constitute a fair sampling of the things which college freshmen have previously had opportunities to learn. A test so constructed might be a fair one for the group for which it was designed but wholly unreliable for another group.

Educational tests are constructed for the purpose of measuring how well children have profited by instruction in a specific field, as arithmetic. To the extent that all the children measured by an educational test have had equal environmental opportunities to learn arithmetic, it is a mental test as well, although probably not a very good one. The weakness of such a test for use as a mental test is that it contains too narrow a sample of the environment. A good battery of educational tests such as the Stanford Achievement Test probably gives as good a measure of mental ability as most of the group intelligence tests.

General intelligence. The concept of intelligence is not a new one although the developments of modern psychology have greatly clarified our notion of what it is. Many psychologists have given definitions of intelligence. In a symposium[1] on intelligence published in the *Journal of Educational Psychology* in 1921, a number of the leading psychologists gave their definitions. Peterson's definition is as follows: "Intelligence seems to be a biological mechanism by which the effects of a complexity of stimuli are brought together and given a somewhat unified effect in behavior." In their definitions many psychologists emphasize the ability to learn. In fact, while the one just quoted does not mention the ability to learn it is implied. For practical school purposes intelligence may be conceived of as the ability to learn.

QUESTIONS AND EXERCISES

1. Select the ten highest I.Q.'s in the first column of Table VI. Find the average for these. Are the I.Q.'s in the last column corresponding to these as high, or are they higher? Study the ten lowest in the first column of I.Q.'s. Do the corresponding measures in later years tend to improve? Can you in any way explain what you find?

---

[1] Symposium, "Intelligence and Its Measurement," *Journal of Educational Psychology*, Vol. XII, Nos. 3 and 4, pp. 123–147; 195–216. Warwick & York, Inc. 1921.

2. Look up at the end of the chapter the reference entitled Symposium, "Intelligence and Its Measurement," and contrast briefly the views of any two of the writers.

3. Study the data in Table VI in the light of Table VII. Where do most of the I.Q.'s presented in Table VI fall when compared with Terman's data given in Table VII? Would you say that Table VI presents data from a somewhat select group of children?

4. State in your own words what is meant by reliability and validity.

5. Find the I.Q.'s for the pupils listed here:

PUPIL	AGE	MENTAL AGE	I.Q.
1	7 yr. 2 mo.	8 yr. 3 mo.	
2	6 yr. 1 mo.	5 yr. 11 mo.	
3	5 yr. 4 mo.	8 yr. 6 mo.	
4	5 yr. 7 mo.	5 yr. 5 mo.	
5	6 yr. 0 mo.	9 yr. 0 mo.	

These pupils all entered the same section of a first grade. What would you expect to find at the end of the year regarding their achievement?

6. Do you think that most children live — from birth to adult life — in about the same type of environment in which they were born? This question might be considered in another way: Suppose we could grade all environments from A, the best, to Z, the poorest. Do you think that a child born in environment B will likely live in an environment closer to A than to Z? Similarly, if a child is born in environment Y will he, on the average, live in about the same type of environment?

SELECTED REFERENCES

1. Fenton, Norman, and Worcester, Dean A. *An Introduction to Educational Measurements.* Ginn and Company. 1928.
2. Freeman, Frank N. *Mental Tests.* Houghton Mifflin Company. 1926.
3. Kelley, T. L. *Interpretation of Educational Measurements.* World Book Company. 1927.
4. Monroe, W. S. *An Introduction to the Theory of Educational Measurements.* Houghton Mifflin Company. 1923.
5. Peterson, Joseph. *Early Conceptions and Tests of Intelligence.* World Book Company. 1925.
6. Pintner, Rudolf. *Intelligence Testing.* Henry Holt and Company. 1923.
7. Symposium, "Intelligence and Its Measurement," *Journal of Educational Psychology*, Vol. XII, Nos. 3 and 4, pp. 123–147; 195–216. Warwick & York, Inc. 1921.
8. Terman, Lewis M. *The Measurement of Intelligence.* Houghton Mifflin Company. 1916.

CHAPTER IV

MEASURING DIFFERENCES IN CHILDREN

Purpose of this chapter. The purpose of this chapter is to show how data secured as a result of the measurement of the amount of a given trait or skill possessed by children should be treated so as to be more easily interpreted. The results of measurements must be arranged in some sort of orderly fashion before the teacher is able to grasp their full and true significance. In this chapter the aim is to use results of measurements and treat them in ways which will be useful to teachers at work. The method of treatment and interpretation are the important items included. In order to simplify the work as much as possible the same scores will be used to illustrate all the processes presented in this and the succeeding chapter, both of which deal with measurements.

Tabulation of data. The collection of data and the way they are to be tabulated should be determined by the purpose the teacher has in view. It is useless to measure traits and work up the data in a statistical way without a clear conception of what is to be accomplished. One of the first things to do after test papers are scored is to determine the kind of arrangement of the scores that will show their meaning in the light of the problem being studied. If the teacher is studying her class, the individual pupil should not be lost in the tabulation. When only one test is given, it frequently is unnecessary to make any sort of tabulation. In this case the papers may be arranged in a pile so that the paper of the pupil making the highest score is on top, the paper with the next highest score second, and so on for the rest of the papers until the poorest one, which will be placed on the bottom, is reached. This makes it easy to pick out the pupils with scores higher or lower than the norm. Also the middle paper will have on it the median score for the grade. This middle score, or *median* as it is called, may be compared with the norm which represents the median ability of pupils in the particular grade for the country as a whole.

If more than one test is used it is advisable to make an alphabetical list of the pupils in the grade. Opposite the name of each child should be written his scores in appropriate columns. Table VIII shows how the scores made on a number of tests were recorded for a fifth grade. (In the table, numbers have been substituted for the names of the pupils.) This arrangement makes it possible to determine at a glance a pupil's score on any of the tests given. It does not show, however, how one pupil compares with another pupil except in a crude way. The arrangement of scores for comparative purposes will be illustrated later.

When a supervisor or principal is studying the achievement of pupils in a whole school system and the purpose is to compare the achievement of differ-

TABLE VIII. SHOWING SCORES MADE BY THE PUPILS OF A FIFTH GRADE ON CERTAIN STANDARDIZED TESTS AT THE MIDDLE OF THE SCHOOL YEAR

Pupil	Test						
	W-McC Arith.	Monroe Reading R	Monroe Reading C	T-McC Reading T-Score	Spelling	Composition	Handwriting Ayres Quality
1	27	150	13	61	20	4.5	30
2	16	170	11	52	19	5.	40
3	22	133	10	59	16	4.	35
4	24	175	13	46	19	3.	25
5	17	137	8	50	13	1.9	35
6	28	206	14	64	20	3.5	35
7	23	251	18	68	16	2.8	30
8	22	224	16	59	20	5.	35
9	18	86	8	52	9	3.	35
10	27	170	14	61	20	3.5	40
11	21	274	12	54	14	1.	25
12	25	145	12	68	18	2.7	30
13	19	137	10	58	12	3.5	35
14	21	163	12	61	15	3.7	40
15	20	240	19	59	19	3.2	35
16	17	173	9	50	18	2.5	35
17	18	188	14	68	20	6.	40
18	18	137	9	64	16	3.2	35
19	23	240	19	64	19	4.5	30
20	23	130	12	56	16	2.2	30
21	24	137	10	56	19	4.5	40
22	24	150	13	68	20	3.5	30
23	22	123	10	61	19	2.8	25
24	25	130	13	72	19	2.5	25
25	26	135	9	61	20	6.	45
26	16	163	11	61	20	5.	40
27	23	150	9	54	17	2.5	40
28	13	139	10	43	15	3.8	35
29	28	137	11	64	19	5.5	35
30	20	199	13	52	15	2.5	35
31	17	183	16	64	20	4.8	35
32	15	123	12	59	18	3.8	30
33	22	199	18	59	20	2.5	30
34	27	166	9	56	19	5.5	40
35	22	224	18	61	18	4.8	35

ent sections of the same grade or to compare the different grades as a whole, the individual pupil may be disregarded in the tabulation. If, on the other hand, it is desirable to compare the achievement of the individual pupils in one section of a grade with those in another, the identity of the pupil must not be lost in the tabulation. The purpose of the tabulation always has to do with the interpretation of conditions, consequently processes which do not so aid are useless. Nothing is to be gained by the use of complicated processes if simple methods will give the desired results.

It is unnecessary to state that any problem worthy of study justifies extreme care and accuracy in the collection of data. In most sciences several measurements are generally made because slight errors are likely to occur. Errors should be reduced to a minimum by carefully controlling conditions under which tests are given and by accurately scoring, tabulating, and checking results. In educational data small errors are often negligible; however, this should in no wise encourage carelessness. Accurate ways of doing things seldom take more time than inaccurate ways.

Table IX shows the scores for the Woody-McCall Mixed Fundamentals in Arithmetic Test, given in Table VIII, tabulated in the form of a frequency table. The advantage of a frequency table like Table IX lies in one's being able to see at a glance the number of pupils making any score. Any pupil's standing in the class is easily determined from the table. For instance, as shown in Table VIII, Pupil 21 made a score of 24 on the test. Table IX shows that eight pupils made higher scores. Table X is similar to Table IX except that here is shown the number of pupils making certain scores on the same test given on the same day to each of six sections of the fifth grade in a city system. Three of the sections were in one building and three in another. When the scores were tabulated an interesting picture of the conditions was given. Notice

TABLE IX. SHOWING HOW THE SCORES FOR THE WOODY-McCALL ARITHMETIC TEST IN TABLE VIII MIGHT BE TABULATED

SCORE	NUMBER OF CASES (Frequency)
28 — 11	2
27 — 111	3
26 — 1	1
25 — 11	2
24 — 111	3
23 — 1111	4
22 — 11111	5
21 — 11	2
20 — 11	2
19 — 1	1
18 — 111	3
17 — 111	3
16 — 11	2
15 — 1	1
14 —	
13 — 1	1
No. of Cases —	35

Table X. Showing the Scores Made on the Woody-McCall Mixed Fundamentals in Arithmetic Test by the Pupils in the Several Sections of a Fifth Grade

	Building A			Building B			Total
Score	Sec. 1	Sec. 2	Sec. 3	Sec. 1	Sec. 2	Sec. 3	
31	1						1
30	2			1	2	1	6
29	2	1			1	1	5
28	3						3
27	4	1	1	1	2		9
26	1	3	1	4	3		12
25	2	4			4	2	12
24	4	3	2	1	4	2	16
23	4	2	1	2	2	2	13
22	2	4	3	2	2	1	14
21	3	3	2	3	1	3	15
20	2	1	2	2	1	3	11
19	1	2	1	1	2	1	8
18		2	3	2	1	2	10
17		2	1	3	1	2	9
16		3	2	2	1	1	9
15		1	1	2		1	5
14			2	1		1	4
13		2	1	1	1	3	8
12			4			1	5
11			1	2		2	5
10			1	1		2	4
9			2	1	1	1	5
8			2		1	2	5
7			1			1	2
6					1		1
No. Pupils	31	34	34	32	31	35	197

that the pupils in Building A are much better classified with respect to the ability measured than those in Building B.

Sometimes it is desired to tabulate scores so as to study overlapping between grades. A study of Table XI, which is arranged to show this, reveals that there is much overlapping between the fourth and fifth grades; little between the fifth and sixth; a great amount between the sixth and seventh and the seventh and eighth.

Sometimes it is necessary to tabulate scores where there is a wide interval between the highest and the lowest. When this condition is true it is best to group the scores. As a general rule there should be approximately twenty intervals after the grouping is made. Table XII shows the Monroe Reading Scores for Rate listed in Table VIII grouped in intervals of 10. Such a grouping is much more easily handled and for all practical purposes is as accurate as is necessary. The scores may be treated as if they fell at the midpoints of the class intervals.

Central tendencies. The process of collecting and tabulating the results of measurements is but one step in their interpretation. Before it is possible to study the abilities of a pupil it is necessary to have some point of reference, something with which his score may be compared. The remainder of this chapter deals with central tendencies. These have value from two points of view. In the first place, if several groups of pupils are to be studied it is impossible to do so by using the individual scores.

TABLE XI. TABLE SHOWING DISTRIBUTION OF WOODY-McCALL MIXED FUNDAMENTALS TEST SCORES BY GRADES FOR A SMALL SCHOOL SYSTEM

SCORE	GRADE				
	4	5	6	7	8
34					1
33			1	1	2
32			1	4	1
31			1	4	4
30			2	6	6
29			5	3	3
28			10	5	5
27			1	3	2
26			1	1	3
25			1	2	3
24			4	2	1
23		1	2	1	
22		3	1	2	2
21		2	2	1	1
20		2	2	1	1
19		2	2	1	
18	1	3	1	1	
17	5	5	1		
16	3	5	1		
15	5	3	1		
14	3	3			
13	1	2			
12	5	1			
11	3	1			
10	3	1			
9	2	1			
8	1				
7	1				
6	1				
5	1				
4	1				
Medians	12.9	17.2	27.9	28.8	28.9
Norms	13.1	17.8	22.5	25.9	27.8

TABLE XII. SHOWING THE MONROE READING SCORES FOR RATE LISTED IN TABLE VIII GROUPED IN INTERVALS OF TEN

SCORE	FREQUENCY
271–280	1
261–270	
251–260	1
241–250	
231–240	2
221–230	2
211–220	
201–210	1
191–200	2
181–190	2
171–180	2
161–170	5
151–160	
141–150	4
131–140	8
121–130	4
111–120	
101–110	
91–100	
81–90	1

Some expression must be found which summarizes the data for each group. A single expression, as *the average*, gives a convenient and easily understood view of a group. However, it never carries all the facts as do the detailed data. In the second place, if the teacher is studying the traits possessed by a pupil there must be a point of reference. The central tendency furnishes a good point of reference because it is a rather stable measure.

There are three measures of central tendencies in use. Some writers refer to three averages: the mean, the median, and the mode. In such cases the average is used as a general term and may refer to any one of the three measures mentioned. In this book the average is used as a general term and the mean as the specific one, referring to the central tendency found when the sum of the scores of a group of children is divided by the number of children composing the group. The process involved in finding each of the averages will now be illustrated through the use of data already presented in this chapter.

The mean. In Table VIII are given the scores made by the pupils of a fifth grade on a number of standardized educational tests.* Notice that when the scores in the column headed "W-McC Arith." (Woody-McCall Mixed Fundamentals in Arithmetic Test) are added the sum of 753 is found. If it is desired to find the mean score for the grade, it may be done by dividing 753 by 35, the number of scores. This gives a mean of 21.51. In practical school work it is usually unnecessary to carry the mean beyond one decimal place, so 21.5 is used as the mean. In the same way the total for the column headed "Monroe Reading R" (Monroe Silent Reading Test, Revised), is found to be 5887. The mean for this column is therefore 168.2 or, dropping the small decimal, 168. In like manner, the mean for each of the remaining columns may be found.

---

* The scores listed in this table are used throughout the book to illustrate the various methods of handling data with which a teacher should be familiar.

Principals and supervisors frequently desire to study the combined scores from a number of sections of a grade. When this is the case it is generally better to make a frequency table before measures of control of tendencies are found. Table IX shows the Woody-McCall scores in Table VIII arranged in such a table. Table XIII uses the same data in illustrating the processes involved in finding the mean for a frequency distribution. Instead of writing all the scores in a column and adding, each score of a given size is multiplied by the number of pupils earning that score. These products are listed in the column headed F × S. It is only necessary now to total the F × S column and divide by the number of cases, which may be found by adding the numbers in the Frequency column. Probably the tabular method would rarely be used with only 35 scores. With a large number of cases, though, this method is much shorter. The tabular method is illustrated again in Table XIV, where the scores listed in Table X from six sections of a fifth grade have been combined in one frequency table. Here there are 197 scores.

The median. The median is by definition the score or measure found at the midpoint of a distribution when the scores are arranged from the lowest to the highest or from the highest to the lowest. The most important thing to remember about the median is that it represents the midpoint in a distribution.

The median may be used where numerical values are not assigned to the items of the distribution. As an illustration, during one quarter the following grades were given to the members of a class in child psychology: A, A, B, B, B, B, B, C, C, C, C, C, C, C, C, C, C, C, C, D, D, F, F, F, F; here C is the median grade because there are 25 grades and counting from either end of the distribution the midpoint

TABLE XIII. SHOWING HOW TO FIND THE MEAN FOR A FREQUENCY TABLE

SCORE	FREQUENCY	F × S
28	2	56
27	3	81
26	1	26
25	2	50
24	3	72
23	4	92
22	5	110
21	2	42
20	2	40
19	1	19
18	3	54
17	3	51
16	2	32
15	1	15
14		
13	1	13

"Σ" always means "add" or the "sum of."
"N" always means the number of cases.

$$\Sigma FS = 753$$

$$N = 35$$

$$\text{Mean} = \frac{\Sigma FS}{N} = 21.5$$

falls at the 13th score, which is in the C group. In like manner, a teacher may rank her pupils from best to poorest. The pupil whose name is at the midpoint represents the median of the group.

TABLE XIV. ILLUSTRATING THE TABULAR METHOD OF FINDING THE MEAN

SCORE	F	F × S
31	1	31
30	6	180
29	5	145
28	3	84
27	9	243
26	12	312
25	12	300
24	16	384
23	13	299
22	14	308
21	15	315
20	11	220
19	8	152
18	10	180
17	9	153
16	9	144
15	5	75
14	4	56
13	8	104
12	5	60
11	5	55
10	4	40
9	5	45
8	5	40
7	2	14
6	1	6

$\Sigma FS = 3945$
$N = 197$
Mean = 20.03

A clear understanding of the median is impossible unless the student computes it for a number of distributions. The median is sometimes said to be the $\frac{N+1}{2}$ score when the scores are arranged in order. Reference to Table VIII shows that there are 35 scores in the column headed "W-McC Arith." The median then for these scores would be the $\frac{35+1}{2}$ or the 18th score after all have been arranged in order of size.

When this is done we have the following: 28, 28, 27, 27, 27, 26, 25, 25, 24, 24, 24, 23, 23, 23, 23, 22, 22, 22, 22, 22, 21, 21, 20, 20, 19, 18, 18, 18, 17, 17, 17, 16, 16, 15, 13. The median, then, is found to be 22. For most school purposes the method here used gives results sufficiently accurate. Sometimes it is desirable to find the exact median. Then interpolation becomes necessary. This is explained as one of the steps in the next illustration.

In dealing with measures of central tendency we meet with the problem of continuous and discrete series of measures. Educational, physical, and mental test scores furnish examples of continuous series. School attendance records, vital statistics, and data of similar nature, furnish most of our examples of discrete series. Of the arithmetic scores listed in the preceding paragraph, not all the five pupils who received a score of 22 have exactly the same mathematical ability. We might think of the abilities of these five pupils as ranging all the way from the ability to work almost 23 to the ability to work barely 22. From this viewpoint the median for the group would not be 22 but 22.5. In a small array of scores, however, it is probably best to take the score as it stands, since it is doubtful whether any additional accuracy is gained by interpolation when the number of cases is not large.

The data used in Table XIV may be used again to illustrate the method of finding the median in a tabular distribution. Since there are 197 frequencies in Table XIV, the median will be the score opposite the 99th frequency. It will be noticed that, adding from the lower end of the frequency column, 91 cases are found by the time we reach the 15 cases opposite score 21. This means that, in order to reach the median, 8 of the 15 scores opposite score 21 must be reached. In dealing with a continuous series, one of the first things to determine is what a given score means. In the case under consideration a score means anywhere between 21 and 22. Theoretically, the 15 scores are scattered evenly between 21 and 22. Therefore, since 8 of the 15 are needed to reach the midpoint, eight-fifteenths of one — or the distance between 21 and 22 — added to 21 gives the median. This gives approximately .5 to be added to 21 or a median of 21.5. Had the scores in Table XIV run 2, 4, 8, and so on by twos, it would have been necessary to take eight-fifteenths of the class interval of 2. Had the interval been 5, the proper fractional part of that interval would have been secured.

Another point to consider in finding measures of central tendencies is that of class limits. In the illustration just given 21 means anywhere between 21 and 22. Sometimes a score merely represents the midpoint of a class interval. Consider the column headed "Handwriting" in Table VIII. Here scores falling nearer to 35 than to 40 or 30 are listed as 35. That is, a score listed as 35 means a score somewhere between 33 and 38. Had such scores been used in the previous illustration, the number found by interpolation would have been added to the lower limit of the class interval. In computing medians the teacher will find many special cases. In general, the median should be represented by some actual score made on the test. What the average teacher needs is not refined statistical technique but an interpretation of the data. Less emphasis should probably be placed on statistical processes and more on analysis, interpretation, and application.

The mode. The mode is by definition the most frequent score. When a test is given to a group of pupils the score most frequently made is the mode. If reference is made to Table VIII it will be seen that 14 pupils received a score of 35 on the handwriting test. The mode then is 35, because that score was received by more pupils than any other. It may be found by mere inspection of the data. Its calculation is so simple that no further illustrations are needed.*

---

* This is sometimes called the *crude* mode. The *true* mode is found by rather intricate statistical procedure and is not thought to be of sufficient importance to the school worker to be included here.

QUESTIONS AND EXERCISES

1. Find the mean for the Thorndike-McCall Reading Scale data, T-Scores, Table VIII.

2. Find the mean for the Woody-McCall Mixed Fundamentals in Arithmetic data given in Table VIII.

3. Find the median for each of the above.

4. How do the medians and means found in the above compare in size?

5. Find the median or mean for each of the sections given in Table X. Which is the poorest section? Which teacher do you think has the most difficult problem in teaching? Why? Which do you think has the easiest? Why?

6. How does the fifth grade in Table XI compare with the various sections of the fifth grade in Table X? Are there any sections of the fifth grade, Table X, equal in ability to the eighth grade as given in Table XI?

7. What per cent of the pupils in each grade in Table XI exceed the median of the grade above? Do you think that you would find such overlapping in almost any school situation?

8. If scores are available, study a local school with respect to overlapping between grades.

SELECTED REFERENCES

1. Garrett, H. E. *Statistics in Psychology and Education*, Chaps. I and II. Longmans, Green and Company. 1926.
2. Gavett, G. I. *A First Course in Statistical Method*, Chap. IV. McGraw-Hill Book Company, Inc. 1925.
3. Gilliland, A. R., and Jordan, R. H. *Educational Measurement and the Classroom Teacher*, Chap. XVIII. The Century Co.

4. Holtzinger, K. J. *Statistical Methods for Students in Education*, Chaps. II, III, VI. Ginn and Company. 1928.
5. Kelley, T. L. *Statistical Method*, Chap. III. The Macmillan Company. 1923.
6. Odell, C. W. *Educational Statistics*, Chaps. II and III. The Century Co. 1925.
7. Otis, A. S. *Statistical Method in Educational Measurement*, Chap. II. World Book Company. 1925.
8. Paulu, E. M. *Diagnostic Testing and Remedial Teaching*, Chap. II. D. C. Heath and Company. 1924.
9. Pressey, S. L., and Pressey, Luella C. *Introduction to the Use of Standard Tests*, Chap. III. World Book Company. 1922.
10. Rugg, H. O. *Statistical Methods Applied to Education*, Chap. V. Houghton Mifflin Company. 1917.
11. Smith, H. L., and Wright, W. W. *Tests and Measurements*, Chaps. II, III, IV. Silver, Burdett and Company. 1928.
12. Thorndike, E. L. *An Introduction to the Theory of Mental and Social Measurements*, Chap. IV. Teachers College, Columbia University. 1913.
13. Thurstone, L. L. *The Fundamentals of Statistics*, Chaps. 10, 11, and 12. The Macmillan Company. 1925.
14. Trabue, M. R. *Measuring Results in Education*, Chap. IX. American Book Company. 1924.
15. Yule, G. U. *An Introduction to the Theory of Statistics*, Chap. VII. Charles Griffin and Company, Ltd., London. 1922.

CHAPTER V

MEASURES OF INDIVIDUAL DIFFERENCES

Purpose of this chapter. The purpose of this chapter is to show how the differences between pupils may be studied. It can readily be seen that measurements of variability would be unnecessary if children did not differ among themselves. If the school situations were the same for all children and all children responded in the same way to these situations, measures of central tendencies would be practically the only measures needed by the teacher. However, we know that this condition does not exist. We know that the really same situation never exists for any two pupils and we know that no two children ever react exactly alike to any situation which is nearly the same for the two. Learning is an individual affair.

The measurement of the results of teaching is concerned with more than the average results produced in the group as a whole. It has to do with the results produced in the individual. When examined by means of a standardized test, the children in two sections of a grade may make such scores that the averages are approximately the same, yet when the individual scores are studied the two sections may differ very widely with respect to the achievement of the individual pupils in the sections. Reference to Table X shows that the pupils of the fifth grade in Section 1, Building A, made about the same average as those of Section 2, Building B, yet the pupils in the one section are scattered much more widely than in the other.

Measures of variability give additional means of interpreting scores. They are necessary if the teacher is to secure an idea of the variability of her pupils in the trait measured. For purposes of interpretation and application these measures are of great practical importance. For example, the teachers whose pupils made the scores listed in the table have different problems in teaching. The teacher of Section 1, Building A, according to the test results, has a group of pupils who are fairly equal in ability in arithmetic. These pupils are all very close to the average for the section. The teacher of Section 2, Building B, faces an entirely different situation. Her pupils vary enormously in achievement in arithmetic. Her problems in the teaching of arithmetic are evidently much harder than those of the first teacher. Teaching means one thing when all the pupils in a class are of approximately the same ability; it means something vastly different when they are unequal in ability.

In comparing measures of variability with measures of central tendency the following contrast should be noted. The central tendency gives a definite position or point in an array of scores. Thus in Table X the mean for Section 1, Building A, is 24.9. The median is 24. These two measures give definite points or positions. The mean occupies such a position that the sum of the differences, when it is subtracted from each of the scores greater than it, will be equal to the sum of the differences when each of the scores less than the mean is subtracted from it. The median is of course the mid-score. A measure of variability, however, gives a definite distance. It tells how far we must go from the central tendency to include a certain per cent of the scores. The measure of variability should tell which of several groups, compared by means of the same test, has in it pupils of the greatest inequality of ability. In other words, the group with the smallest measure of variability is the most homogeneous. These facts are important ones and will be referred to again when the methods of calculating these measures are illustrated.

Several measures of variability are in use. The methods used in their calculation, together with practical applications to concrete data, are shown in the following paragraphs.

The range. The variation in ability within a given school grade may be shown by simply stating the highest and lowest scores or the difference between them, *i.e.*, the actual range of scores. This is the simplest measure of the spread of the scores and is, as a rule, of little value. A measure giving merely the range of scores tells nothing of the nature of the distribution of the scores between the two extremes. An examination of the scores made by the pupils in Sections 2 and 3, Building B, listed in Table X, reveals the fact that the range of scores is almost the same for the two sections. A further study, however, shows that the scores are not distributed in the same way in the two sections.

It is plain that the range has many limitations as a measure of the variability to be found within a group. A better measure is one in which the score made by each pupil is used. Also the measure should represent a definite distance from a given position. The mean and median furnish points from which deviation can be measured. The mean deviation (A.D. or M.D.), and the standard deviation (σ), are the measures of variability in most general use.

The mean deviation. The mean or average deviation of an array of scores is the arithmetical average of the deviations of the scores from a central tendency, no regard being paid to signs. The A.D. can be calculated from either the mean or median. It is generally calculated from the mean. Table XV illustrates the method of calculating the A.D. for a tabular distribution. This table presents data used in the previous chapter for illustrating methods of finding central tendencies. To find the A.D. it is unnecessary to arrange the scores in rank order, as is done in the table. The mathematical work involved in finding this measure is very simple. The mean for these data was found to be 21.5 (Table XIII). It is only necessary now to find how far each score deviates from the mean, add these deviations — paying no attention to signs — and divide by the number of scores. The A.D. is thus seen to be the mean of the deviations from the central tendency, when no attention is paid to the signs. Sometimes it is necessary to take the midpoint of a class interval as the score. For example, in the illustration just given, the actual scores made on the test were used.

TABLE XV. SHOWING HOW TO FIND THE AVERAGE DEVIATION (WOODY-MCCALL DATA FROM TABLE VIII)

SCORE	FREQUENCY	DEVIATION	FD
28	2	6.5	13.
27	3	5.5	16.5
26	1	4.5	4.5
25	2	3.5	7.
24	3	2.5	7.5
23	4	1.5	6.
22	5	.5	2.5
21	2	.5	1.
20	2	1.5	3.
19	1	2.5	2.5
18	3	3.5	10.5
17	3	4.5	13.5
16	2	5.5	11.
15	1	6.5	6.5
14			
13	1	8.5	8.5

From Table XIII (C. Tendencies) the average = 21.5

$N = 35 \qquad \Sigma FD = 113.5 \qquad A.D. = \frac{\Sigma FD}{N} \qquad A.D. = 3.2$

The table shows that 5 pupils made a score of 22. It might be desirable in some cases to use the midpoint between 22 and 23 and so on for the rest of the scores.

The standard deviation. For experimental and research purposes the standard deviation is our most valuable measure. It is generally referred to as "σ," sigma. This measure is always calculated from the mean. It is by definition the square root of the mean of the squares of the deviations from the mean. Listing the steps necessary for its calculation makes the definition more easily understood In order to find "σ" the following steps are necessary:

1. Find the mean.
2. Find the deviations from the mean.
3. Square the deviations.
4. Find the sum of these squared deviations.
5. Divide this total by the number of scores.
6. Extract the square root of the quotient found in 5 above.

The "σ" of an array of scores is therefore the square root of the mean of the squares of the deviations of the individual scores from the mean score. Because of the importance of this measure, several illustrations are given in the three tables in this chapter.

Table XVI illustrates the method of finding "σ" when the scores are not grouped in a frequency table. The score column is taken directly from Table VIII. The mean is found to be 21.5. The D column is composed of the differences between the scores and the average. The D squared column is simply composed of the differences squared. Sigma is then found by extracting the square root of the mean of these squares. When the scores are grouped in a

TABLE XVI. SHOWING METHOD OF FINDING STANDARD DEVIATION

SCORE	D	D SQUARED
27	5.5	30.25
16	5.5	30.25
22	.5	.25
24	2.5	6.25
17	4.5	20.25
28	6.5	42.25
23	1.5	2.25
22	.5	.25
18	3.5	12.25
27	5.5	30.25
21	.5	.25
25	3.5	12.25
19	2.5	6.25
21	.5	.25
20	1.5	2.25
17	4.5	20.25
18	3.5	12.25
18	3.5	12.25
23	1.5	2.25
23	1.5	2.25
24	2.5	6.25
24	2.5	6.25
22	.5	.25
25	3.5	12.25
26	4.5	20.25
16	5.5	30.25
23	1.5	2.25
13	8.5	72.25
28	6.5	42.25
20	1.5	2.25
17	4.5	20.25
15	6.5	42.25
22	.5	.25
27	5.5	30.25
22	.5	.25

$$\text{“}\sigma\text{”} = \sqrt{\frac{\Sigma D^2}{N}} = \sqrt{\frac{532.75}{35}} = \sqrt{15.22} + = 3.9.$$

Mean $= 21.5$. $\Sigma D^2 = 532.75$.

frequency table, it is necessary to find an FD^2 column. This simply means that the D^2's must be multiplied by the appropriate number of frequencies before "σ" is found as illustrated in Table XVII.

TABLE XVII. SHOWING METHOD OF FINDING STANDARD DEVIATION FOR SCORES GROUPED IN A FREQUENCY TABLE

SCORE	FREQUENCY	DEVIATION	DEVIATION SQUARED	FD^2
28	2	6.5	42.25	84.50
27	3	5.5	30.25	90.75
26	1	4.5	20.25	20.25
25	2	3.5	12.25	24.50
24	3	2.5	6.25	18.75
23	4	1.5	2.25	9.00
22	5	.5	.25	1.25
21	2	.5	.25	.50
20	2	1.5	2.25	4.50
19	1	2.5	6.25	6.25
18	3	3.5	12.25	36.75
17	3	4.5	20.25	60.75
16	2	5.5	30.25	60.50
15	1	6.5	42.25	42.25
14				
13	1	8.5	72.25	72.25

Mean = 21.5

$\Sigma FD^2 = 532.75.$

$$``\sigma" = \sqrt{\frac{\Sigma FD^2}{N}} = 3.9$$

Sigma is one of the most important measures used in individual psychology and education. The teacher should thoroughly understand its computation.

The semi-inter-quartile range is another measure frequently used. The measure is usually referred to as Q. Its calculation is rather simple. When the Woody-McCall scores in Table VIII are arranged from highest to lowest, as in Table XIII, we find the median to be 22. The midpoint of a distribution is sometimes referred to as Q2. Now, if another midpoint is found for the half of the distribution below Q2, this is known as Q3, and that for the half above the median is known as Q1. That is, these points divide the distribution into four equal parts. Q is found by subtracting Q3 from Q1 and dividing by 2. The formula is $\frac{Q1 - Q3}{2} = Q$. For the data mentioned above $Q = 25 - 18 \div 2 = 3.5$. In a frequency table Q1 and Q3 are found in the same way as the median. One half the difference between the scores located at those two points gives the semi-inter-quartile range.

The relative sizes for a normal distribution of the three measures of variability treated here are given below:

$$\begin{aligned} \sigma &= 1.353 \text{ A.D.} \\ \sigma &= 1.482 \text{ Q.} \\ Q &= .6745\, \sigma \\ \text{A.D.} &= .7979\, \sigma \\ Q &= .845 \text{ A.D.} \end{aligned}$$

It will be noticed that "σ" is the largest of the measures of variability and Q the smallest.

Measurement of variability. The coefficient of variability is a measure which helps us to determine which of several groups is the most variable. It is generally found by multiplying sigma by 100 and dividing by the mean. Thus, from Table XVII we find sigma for the Woody-McCall scores to be 3.9 and the mean 21.5. The C. of V. is therefore 100 × 3.9 ÷ 21.5, or 18.1. The C. of V. for the spelling scores is 15.4. The pupils are thus seen to be more variable in arithmetic than in spelling. This could be expressed in terms of per cent if we so wished. The C. of V. for the spelling scores is probably too low, however, since a number of the pupils spelled the 20 words and probably could have spelled more; we have not measured the complete range of spelling ability represented in the grade.

Measures of relationship. Statistical methods exist for the purpose of helping us to understand and interpret our data. The coefficient of correlation tells us whether there is a relationship existing between measurements of different abilities. This measure tells us, for instance, what the relationship is between ability in spelling and ability in arithmetic. The coefficient of correlation is generally referred to as r. When r is 1, there is perfect correlation; that is, the pupil who is best in the first ability is best also in the second, and so on. The range of relationships between abilities may vary all the way from plus 1 through 0 to minus 1. An r of -1 would indicate that the pupil best in one ability is poorest in the other, the second best in the one is the second poorest in the other, etc. The size of r indicates whether there is a high, low, or no degree of relationship. If r has a negative sign it indicates a negative relationship.

How to find the coefficient of correlation. The method of finding a coefficient of correlation is shown in Table XVIII.

This measure is always found between two sets of data secured from the same subjects and it tells how closely the two abilities measured are related. Suppose a group of children have been given two standardized tests. Then it is possible by means of this measure to determine the relationship between the abilities measured. In working a coefficient of correlation the following steps are involved:

1. Find the mean for each set of scores.

2. Find the deviations for each set of scores from the mean for that set. (Columns X and Y in Table XVIII.)

3. Find sigma for each set of scores. (The process is illustrated in Table XVI. Columns X and Y in Table XVIII were used to find sigma.)

4. Multiply the deviation of each score from the one mean by the corresponding deviation from the other; that is, for Pupil 1, his two deviations are multiplied together. (Columns XY and − XY were constructed from these products. It is necessary here to consider the plus and minus deviations.)

5. Find the difference between the two columns constructed according to 4 above. (This difference equals $\Sigma X \cdot Y$ in the formula.)

6. Substitute in the formula $r = \frac{\Sigma X \cdot Y}{N(\sigma X \times \sigma Y)}$. In this formula $\Sigma X \cdot Y$ equals the difference found in 5 above. "N" equals the number of cases or pupils tested. "σX" equals the sigma for one set of scores and "σY" for the other.

TABLE XVIII. SHOWING HOW TO FIND A COEFFICIENT OF CORRELATION

PUPIL	W-McC.	SPELL.	X	Y	X^2	Y^2	XY	– XY
1	27	20	5.5	2.4	30.25	5.76	13.20	
2	16	19	–5.5	1.4	30.25	1.96		–7.70
3	22	16	.5	–1.6	.25	2.56		–.80
4	24	19	2.5	1.4	6.25	1.96	3.50	
5	17	13	–4.5	–4.6	20.25	21.46	20.70	
6	28	20	6.5	2.4	42.25	5.76	15.60	
7	23	16	1.5	–1.6	2.25	2.56		–2.40
8	22	20	.5	2.4	.25	5.76	1.20	
9	18	9	–3.5	–8.6	12.25	73.96	30.10	
10	27	20	5.5	2.4	30.25	5.76	13.20	
11	21	14	–.5	–3.6	.25	12.96	1.80	
12	25	18	3.5	.4	12.25	.16	1.40	
13	19	12	–2.5	–5.6	6.25	31.36	14.00	
14	21	15	–.5	–2.6	.25	6.76	1.30	
15	20	19	–1.5	1.4	2.25	1.96		–2.10
16	17	18	–4.5	.4	20.25	.16		–1.80
17	18	20	–3.5	2.4	12.25	5.76		–8.40
18	18	16	–3.5	–1.6	12.25	2.56	5.60	
19	23	19	1.5	1.4	2.25	1.96	2.10	
20	23	16	1.5	–1.6	2.25	2.56		–2.40
21	24	19	2.5	1.4	6.25	1.96	3.50	
22	24	20	2.5	2.4	6.25	5.76	6.00	
23	22	19	.5	1.4	.25	1.96	.70	
24	25	19	3.5	1.4	12.25	1.96	4.90	
25	26	20	4.5	2.4	20.25	5.76	10.80	
26	16	20	–5.5	2.4	30.25	5.76		–13.20
27	23	17	1.5	–.6	2.25	.36		–.90
28	13	15	–8.5	–2.6	72.25	6.76	22.10	
29	28	19	6.5	1.4	42.25	1.96	9.10	
30	20	15	–1.5	–2.6	2.25	6.76	3.90	
31	17	20	–4.5	2.4	20.25	5.76		–10.80
32	15	18	–6.5	.4	42.25	.16		–2.60
33	22	20	.5	2.4	.25	5.76	1.20	
34	27	19	5.5	1.4	30.25	1.96	7.70	
35	22	18	.5	.4	.25	.16	.20	
Mean	21.5	17.63					193.80	–53.10

$\sigma X = 3.9$
$\sigma Y = 2.7$
$N = 35$

$$r = \frac{\Sigma X \cdot Y}{N(\sigma X \times \sigma Y)} = r = \frac{193.80 - 53.10}{35(3.9 \times 2.7)} = .38$$

$$r = .38$$

It is necessary for the student to find r for several sets of data in order to understand the process.

There are many other statistical devices which the student of education will need, if his aim is to work on a high level. He will do well early in his career to become interested in methods of experimentation and to develop habits of considering problems in an objective and quantitative way. The real student is not satisfied with mere opinions and subjective judgments.

Sometimes the column method of finding r is very laborious because of the large number of scores involved. When this is true a tabular method is used. Because this method is not frequently used by teachers, space has not been taken to illustrate the method here. Any of the references at the end of the chapter will furnish an illustration of the method.

QUESTIONS AND EXERCISES

1. Arrange the Monroe Reading C Scores and the Thorndike-McCall Reading T-Score listed in Table VIII, page 61, as in Table XVIII.
2. Find the mean for each column.
3. Find the "X" and "Y" columns by finding the difference between each score and the mean.
4. Find the "X^2" and "Y^2" columns and from these the corresponding standard deviations (sigmas).
5. Find the "+ XY" and the "– XY" columns by multiplying corresponding deviations together and keeping the signs straight.

6. After all the above has been done substitute in the formula for finding r,

$$\left(r = \frac{\Sigma X \cdot Y}{N(\sigma X \times \sigma Y)}\right).$$

7. Write out from memory a statement of how to find r which one not familiar with the method could follow.

8. Find the coefficient of variability for the Monroe and Thorndike-McCall scores (Table VIII). In which reading test is the highest C. of V. found?

9. Look up one of the references dealing with the coefficient of correlation. Write a paragraph which explains this measure of relationship.

SELECTED REFERENCES

1. Garrett, H. E. *Statistics in Psychology and Education*, Chaps. III, IV, and V. Longmans, Green and Company. 1926.
2. Gavett, G. I. *A First Course in Statistical Method*, Chaps. VII, VIII, and IX. McGraw-Hill Book Company. 1925.
3. Gregory, C. A. *Fundamentals of Educational Measurement*, Chaps. XI and XII. D. Appleton and Company. 1922.
4. Holtzinger, K. J. *Statistical Methods for Students in Education*, Chaps. VII, VIII, IX, X. Ginn and Company. 1928.
5. Kelley, T. L. *Statistical Method*, Chaps. IV and VIII. The Macmillan Company. 1923.
6. Odell, C. W. *Educational Statistics*, Chaps. IV, V, VI. The Century Co. 1925.
7. Otis, A. S. *Statistical Method in Educational Measurement*, Chaps. VIII, IX, XI, XV. World Book Company. 1925.

8. Rugg, H. O. *Statistical Methods Applied to Education*, Chaps. VI, VII, IX. Houghton Mifflin Company. 1917.
9. Thorndike, E. L. *An Introduction to the Theory of Mental and Social Measurements*, Chaps. X and XI. Teachers College, Columbia University. 1913.
10. Thurstone, L. L. *The Fundamentals of Statistics*, Chaps. 13–22. The Macmillan Company. 1925.
11. Trabue, M. R. *Measuring Results in Education*, Chap. XI. American Book Company. 1924.
12. Yule, G. U. *An Introduction to the Theory of Statistics*, Chaps. VIII, IX, X. Charles Griffin and Company, Ltd., London. 1922.

CHAPTER VI

LEARNING

What is learning? Learning means developing new ways of reacting by modifying old ones. The environment is ever changing and as it changes man finds it necessary to make new adaptations or changes in himself as well as in his environment. Indeed, man is himself continually changing because of physiological processes which are taking place, and these changes in internal conditions demand new adjustments. We might think of the human organism, as well as all other organisms, as acting so as to maintain a kind of equilibrium between itself and its environment. Learning is generally referred to as the process whereby adjustments become more or less permanent ways of reacting. All the permanent adaptations made since birth may be considered learned. A learned response is permanent, however, only in that it persists in a modified form. No learned reaction ever reaches a final form; either forgetting, additional learning, or integration into larger reaction systems takes place. Learning involves both the modification of existing ways of reacting as well as the integration of these ways into larger wholes. Our present ways of acting, thinking, feeling, and other habitual methods of responding represent what is left of past experiences as they have been modified and integrated.

Learning, then, means adjustment to an environment which is constantly changing — changing, if for no other reason, because the learner is changing. The learner is modified or changed as he reacts to stimuli. For purposes of study the modifications made may be considered from several viewpoints. First, what observable changes are noticed in an individual's reactions? In any motor performance the effects of practice may be noticed. For example, in learning to write definite changes may be seen in the child's handwriting and the improvement measured. Psychology is emphasizing at present as never before the importance of this type of learning. We no longer think of education as a process concerned only with the mind of the child, but as a process which involves the whole individual and develops a trained doer as well as a trained thinker.

Second, learning means not only that external behavior is changed but also that some physiological change has taken place in the organism. Just what this change is we are unable at present to state with as much precision as one could desire. Any change in external behavior indicates also some change of a physiological nature in the organism. Since the nervous system is the great integrating mechanism by means of which the individual is coördinated in its behavior, we are warranted in thinking that there must be some change in neural patterns. Other changes probably take place in the muscles, glands, and the various organs of the body.

In the third place, learning in man, practically, if not always, also involves mental adjustments. It is impossible to study these in an objective manner except as they are reported in some way by the learner. However, their importance in the learning process cannot be doubted. Memories, ideas, images, and similar mental processes, are necessary for the higher types of learning, if not for all. Just as learning from the motor aspect involves the elimination of useless movements and thus produces greater precision so, from the mental, it involves the building up of clear memories, ideas, images, and other mental processes. Mental adjustments are not to be contrasted with motor. Sometimes for the sake of simplicity we emphasize the one and then the other, but both must be viewed as aspects of the same thing, namely, the action of a unit, an individual, in relation to stimuli. Sometimes one aspect is minimized in behavior and sometimes the other. In learning, the behavior of the child is so modified that his subsequent reactions will be different from those which would have otherwise been made.

Learning, then, is the process whereby changes are made in the behavior of organisms with respect to stimuli. What we are later in life is determined by what we were at its beginning plus all the changes that have been made in our behavior as we have reacted to the situations in which we have been placed. The chief problems of education have to do with the kinds of changes which should be made and the most economical ways of making these changes. The first problem relates to the skills, habits, knowledges, ideals, and attitudes which should be acquired. These in turn relate to the curriculum, the kinds of situations which should be provided so as to produce the desired changes, or achieve the desired objectives, as they are often called. It cannot be overemphasized that, taken in a broad sense, the materials about which individuals are active as children will determine what they will be as adults. This is but another way of saying what has been said before in a slightly different way, namely, that an adult is the result of the changes that have been made in the individual's way of reacting. These changes will be determined by the materials to which the child reacts. This involves also the second problem of education, the most economical ways of learning. The teacher enters into these two problems either as a motivating factor or as a maker of situations which call for the desirable type of response or as both.

The physiological basis of learning. For the purposes of the teacher it is probably more profitable to study learning as modification of behavior, yet it must be remembered that all behavior is based on physiological processes. What all these are and what their nature is we do not yet completely understand. The organism is an integrated unit. This integration of an organism or its unity is made possible by the nervous system. Changes in the organism's behavior must be considered as manifestations of changes in its neural organization. The nervous system is peculiarly fitted for the function it performs. This system is made up of relatively independent units or cells called *neurones*. Each neurone is made up of a cell body and long filaments with arborized endings. These fibers vary in length, according to their location and the function they perform, from less than an inch to several feet. From the viewpoint of the integration or the coördination of the total individual so as to give a unified response in adaptation the most important characteristics of the nervous system are the length of the fibers, the endings of the fibers, and the centers in which many of the fibers end.

Just what takes place in the nervous system during learning we are unable at present to state definitely. Probably some sort of modification occurs at the *synapse*, the place where the arborized endings of one neurone lie near those of another. The best theory seems to be that some kind of modification takes place at the synapse so that activity set up in the sensory organs by a stimulus tends to be effective for the arousal of activity in distant muscles or glands more readily. Just what happens at the synapse we do not know; neither do we know how neural activity in one neurone arouses similar activity in another and so on until the muscle or gland is reached.

The student has already come in contact with a number of theories as to what takes place in the nervous system during learning. Many of these theories speak of the formation of connections at the synapse. It must be remembered that connection here is used in a broad sense. It merely means that some sort of modification takes place so that activity in one neurone more readily sets up a similar process in another. Modification seems to be a better term, since connection implies a spatial change while in reality it seems reasonable to suppose the change to be a chemical one which probably does not imply actual linkage. In the same way, instead of speaking of neural impulses as traveling across the synapse from a sensory end-organ to a muscle or gland, we should probably speak of neural activity, as this term does not imply the transmission of substances from one part of the nervous system to another — but merely the arousal of a state or condition. The function of the nervous system is primarily one of coördination and adaptation. In learning, such modifications are made in the neural mechanism that a given stimulus acting upon a sense organ causes a release of energy in distant parts of the organism.

Stimulus-response hypothesis. The assumption underlying this hypothesis is that the relationship of cause and effect holds in the fields of human behavior as in others. This hypothesis states that every reaction of an individual is a direct result of stimuli. Sensory stimuli, internal and external, initiate all forms of human behavior. Ideas, memories, and other mental processes are the result partly of immediate sensory stimulation and partly of the effects of previous reactions. The term situation is used to refer to all these factors: sensory stimuli, effects of previous reactions, bodily condition of the reacting organism, and all other factors which condition a given reaction. An individual reacts to a situation; this reaction adapts the individual to the situation by changing the situation; a reaction is made to the new situation which in turn adapts the individual to this new situation, creating once more a new one. Thus it is continuous. The individual is always active with respect to its environment. The environment might be conceived of as composed of a series of successive situations to which the individual reacts from the beginning of its life until its death. How it reacts to any situation in this chain is determined by its original nature and the way it has previously reacted. This is an important principle in education and deserves more consideration than is usually given to it by students of education. Since the organism is always reacting and cannot cease to be active and at the same time live, and since the reactions it will make in the future are determined in part by those made earlier, it is highly important that desirable situations be provided.

This is just what is attempted in school. Organized agencies for the education of children seek to find and provide for the child the best materials about which he may be active and to present these in such ways as to get certain desirable reactions. The school is of course not able to determine absolutely the character of the child's development through the control of external stimuli for there are many internal ones, such as hunger and sex, which are important in the development of the individual.

The stimulus-response hypothesis does not mean that an individual's actions are wholly determined by his present environment because his purposes, aims, and ideals enter into every situation and partly determine his actions. These are a result of what he was at birth and the adaptations he has made. The present environment is to a large extent a function of the past. No individual at any time of life has his behavior entirely determined by his present external stimuli.

Change and learning. Closely related to the preceding and following paragraphs is the subject of change and learning. Physiological processes are continually occurring in the organism. These alter its condition or state and are the cause of new attempts at adjustment. In like manner, changes taking place in the environment destroy the equilibrium or *status quo* which has been established by previous adjustments and thus call for new ones. All changes whether internal or external ultimately must be conceived of as physiological. These furnish the motive or urge for action on the part of the individual. This is a fundamental fact of all learning and will be considered at length in the chapter on motivation and learning.

Self-activity and learning. It should be unnecessary to state that learning takes place only when a pupil is active, yet many teachers totally ignore this fact. All learning takes place because the organism is capable of activity. Activity on the part of the teacher is of value to the pupil only when that activity becomes part of a situation to which the pupil responds. If we wish the pupil to learn, school situations must be so arranged that he will respond to them. Teachers and parents need to realize that there truly is no royal road to learning. The only aid we can give the pupil lies in the selection of subject matter or the materials of instruction and its organization and presentation. By properly studying the interests and past experiences of the child we are able to determine whether he is ready to respond to the situations which involve the materials we wish him to learn. The curriculum, the laboratory, the playground, the school building, and even the teacher have no function other than making conditions conducive to desirable pupil activity.

Activity is not only a means in the education of children; it is also a goal. The well-educated individual is one who not only is able to meet situations and master them but desires to meet them. The school should not only teach boys and girls to feel and think concerning situations but also to search actively for desirable types of situations.

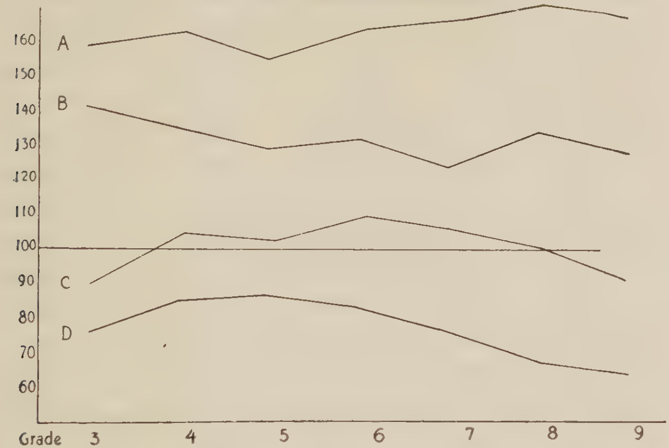
In school work it is necessary to provide situations through which the individual will learn to plan and execute undertakings. Many cases of maladjustment later in life are direct outcomes of training or lack of training in objective self-activity in the early school years. Here, as everywhere in her work, the teacher must think in terms of individual children.

The shy, timid, retreating, sensitive, moody child must be provided with learning experiences which take him out into the world of deeds. Many children are passive throughout life because of lack of self-confidence which might readily have been overcome in the early grades. To study a child of this type and outline a procedure for providing him with such learning experiences that he will actively seek self-realization through objective behavior is a task which calls for all the tact and skill a teacher can command. No set rule can be set for handling all cases of this kind. In general, the teacher should not call the attention of the child to his deficiency. Neither should the deficiency be called to the attention of the average parent, for often the parent does not have the skill necessary for aiding the teacher in the matter. Tasks should be assigned which give opportunity for such learning as will overcome the difficulty, not aggravate it. Sometimes it is necessary to start with very simple situations — but situations which the pupil feels are worth while — and gradually go by slow degrees to situations which demand the maximum degree of the type of behavior desired.

One of the writers once had a student who could not be induced to do work at the blackboard in the presence of other pupils. It took nearly a year of training before the student volunteered to make a class report or do other work which centered the attention of the class upon him. The problem was met by first making a close personal friend of the student and having him do little tasks for the instructor. Gradually, he was led to look up references in the library and copy these on the blackboard before class time. At first this was always done before the class period but finally the student reached the point where he voluntarily made specific comments and elaborations. This is an extreme case, but many types of maladjustment are found in the high school and college as well as in society at large. Many of these are due to improper learning experiences in the early grades. The teacher can do no more important task than that of guiding the potentially maladjusted pupil to a normal and healthy relationship with his environment. This relationship involves more than knowing; it involves doing as well.

Ability to learn. How well we learn depends on many factors, the chief of which is probably mental ability. Learning certainly takes place more rapidly, other things being equal, when we have sufficient background to which we can relate the material under consideration. This fact must also be considered in the measurement of learning ability. Methods of work, too, play an important part in our achievement. Every teacher knows pupils of superior ability who do poor work because of poor habits of study. However, taking all things into consideration, their native ability is probably the most important single factor in that so many of the other factors depend upon it. Native ability determines at the beginning of life how sensitive one is to internal and external changes. It determines to a large degree how readily reactions can be made as well as their degree of permanency. Also it determines to a large extent how well one is able to see relationships and to integrate new experiences with old.

FIGURE 3. SHOWING READING CURVES FOR FOUR CHILDREN WITH DIFFERENT DEGREES OF BRIGHTNESS



(The curves show the achievement of four pupils who were tested by means of the Monroe Standardized Reading Test seven times at yearly intervals. The scores were made comparable by dividing each pupil's score at each testing by the norm for the grade in which he was at that time. The curves show that for these four pupils reading ability is relatively constant.

These curves are not intended to be representative of all persons with similar degrees of brightness. The coefficient of correlation between reading and intelligence for the thirty-four cases in the third grade was found to be .78.)

Figure 3 shows the learning ability of four pupils with respect to reading. These four pupils have taken the Stanford Binet-Simon Intelligence Test a number of times. As measured Pupil A has an intelligence quotient of 181, Pupil B one of 127, Pupil C one of 103, and Pupil D one of 81. The curves in the figure show the achievements of the pupils as measured by the Monroe Silent Reading Test seven times at yearly intervals. The measurements were made at midyear.

The question of the relation between sheer native ability and learning, other factors being eliminated, is a theoretical one. There is at present no way of measuring the intelligence of a child except by measuring in some way how well he has profited by his experiences in certain situations. All research workers would agree to this proposition as a general one. However desirable it would be to know the influence of intelligence in learning, apart from knowledges, skills, and attitudes which have been previously learned and which aid in any future learning, the question of intelligence is capable of study only in terms of how well the individual to be studied has profited by contacts with situations which confront all persons with whom the particular individual is to be compared. If the intelligence of each child in a group is measured in terms of material with which all have had approximately equal contacts and which has been stressed in the same way for all alike, we may reasonably expect to have measurements in comparable terms for the children. This is really what we try to do in constructing intelligence tests and applying them to persons.

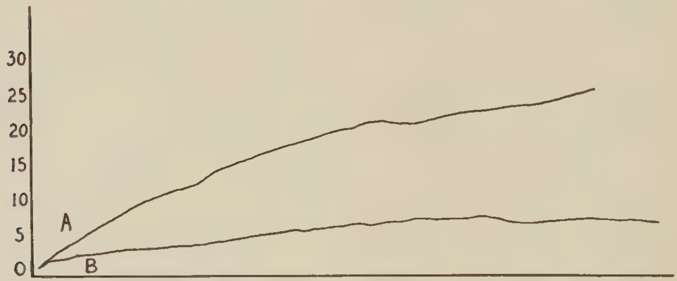
Despite the fact that the school is a selective agency, very wide ranges of ability will be found in almost any school grade. It is not an infrequent condition to find that the best one fourth of the pupils in a grade are superior in school ability to the median of the grade above. Frequently, pupils of the same age are found in the sixth grade some of whom can do eighth-grade work while others are incapable of doing the work of the fourth grade. Figure 4 (p. 106) gives the learning curves of two boys in ability to learn to add simple combinations like 4 + 3, 5 + 2, 7 + 4. Each of these boys was coached for 30 days, 20 minutes per day. At the end of each period a one-minute test in simple addition exercises was given. The boys were each nine years of age. Pupil A had an I.Q. of 143 and Pupil B one of 79 when measured by the Stanford Binet-Simon Intelligence Test. The wide difference in learning ability is apparent. Because of innate differences Pupil B could never hope to rival Pupil A in ability in arithmetic.

Probably a discussion of the relation between intelligence and learning is fruitless since most psychologists consider intelligence as the ability to learn or to profit by experience. In a recent symposium [1] on intelligence this idea seemed to be well-nigh universally accepted. However, the relationship existing between various measures of intelligence and ability to learn the several school subjects is important, especially from the point of view of prediction. This problem will be discussed in connection with the chapters on the school subjects.

---

[1] Symposium, "Intelligence and Its Measurement," *Journal of Educational Psychology*, Vol. XII, pp. 123–147; 195–216. Warwick & York, Inc. 1921.

FIGURE 4. THE FIGURE SHOWS THE LEARNING CURVES OF TWO BOYS WHOSE AGES WERE EQUAL. ONE OF THE BOYS, A, HAD AN I.Q. OF 143 WHILE THE OTHER, B, HAD AN I.Q. OF ONLY 79



Mental organization and learning. The student with poor training in psychology regards the mind as composed of a number of relatively independent units known as mental faculties. This point of view is probably a direct social inheritance from phrenology and a dualistic philosophy. Phrenology as developed by Gall and his followers regarded the brain as composed of a number of independent units, each unit controlling some specific faculty. Dualistic philosophy, in like manner, regarded man as composed of mind and body. The mind according to this philosophy is composed of a number of faculties which are more or less independent. The older textbooks in psychology generally list three faculties:

knowing, feeling, and willing. The theory held that there is a general faculty the training of which in one field trains it for all. The recent studies of Childs, Lashley, Herrick, and other investigators in neurology and allied fields have shown that the idea of independent mental faculties does not conform to neurological facts. Those studies, together with recent biological developments, tend to emphasize the unity in action of the whole organism.

This "unity in action" has led to a functional concept in psychology. The idea involves the stimulus-response hypothesis discussed in a previous paragraph. Putting the two together, we have the notion that the individual reacts as a unit or whole to each of the many situations which confront it. We thus do not speak of feeling as a type of response except as an abstraction. We recognize that feeling is only a part of one complex but nevertheless unified reaction to a definite situation. Feeling, then, cannot be discussed as an entity. When we appear to do so, it is only abstracted from the total response and treated merely as one phase of the response. Such abstractions are made only for the purpose of study and discussion and never with the idea that we are dealing with an entity itself. The entity is the total situation-response phenomena. Psychologists consider knowing, feeling, willing, and other so-called mental faculties not as separate mental processes but as different aspects of the same reaction to a specific situation. The name "mental function" has been given to this concept of the mind as a unit which functions as such.

Transfer and learning. In a problem closely related to that discussed in the preceding paragraph these questions are raised: Is skill gained in one situation carried over into another? Does training in reasoning in one subject facilitate reasoning in another? These questions are answered in the affirmative by those who believe in the doctrine of formal discipline. According to the faculty idea of mental organization, reasoning is a general faculty and a person trained to reason in one subject would thereby receive training which would cause him to reason well in all subjects. Until a few decades ago the view prevailed that training in certain subjects — Latin, Greek, and mathematics generally — would so sharpen the intellect that the student could function efficiently in the various situations he would meet in later life. We know now that what was happening was a kind of selection. Only students with superior intellects could master the subjects and thereby finish school. The advocates of formal discipline did not realize that the success of these students later in life might be attributed to the fact that they were superior to begin with. The classics were undoubtedly taught in the main by men of high character and ideals. This teaching situation probably accounts for the fact that superior individuals were produced.

As stated before, the idea of faculties of the mind is contrary to experimental evidence and modern biological concepts. Likewise, studies of transfer fail to show that training any one of the so-called faculties will produce results which apply with equal effectiveness in a new field different from that in which the faculty was trained. Since psychologists deny that faculties exist, it is necessary to raise the question as to transfer in connection with the functional concept of the mind. Does training in one situation aid the learner in another similar to the first? Space will not permit a discussion of all the experimental evidence here. The student who desires to acquaint himself with the original studies will find a good treatment in Thorndike's *Educational Psychology.*[1]

In general, psychologists are agreed:

1. That there is never complete transfer.
2. That there is practically always some transfer.
3. That there is or may be transfer of a negative as well as a positive type.
4. That transfer depends upon methods of teaching and learning.

The last statement seems to be of great importance for the teacher.

NOTE. A good summary of the view of twenty-four of the leading psychologists who were asked certain questions about transfer is given in *The Reorganization of Mathematics in Secondary Schools,* The Mathematical Association of America. 1923.

Spontaneous movements. In the preceding paragraphs we have consistently emphasized the fact that all behavior has as its basis physiological processes. Spontaneous movements are not exceptions to this rule. The phrase spontaneous activities in reality applies to behavior which is largely determined by the original nature of the child. Internal stimuli are responsible for most of his activities early in life. Since we are unable to note in an objective way the situations to which the child is reacting, we use the term spontaneous. The term implies that the activities are not the result of a definite cause. This implication is of course not true. It must not be forgotten that all responses result from stimulation. Even though such movements are made as a result of internal stimulation they are of service in the development of the child in that movements made as responses to such stimuli may later be made for purposes of adaptation to external ones. Responses to external stimuli are probably developed to a large extent out of those made to internal stimuli.

---

[1] Thorndike, E. L. *Educational Psychology,* Vol. II. Teachers College, Columbia University. 1913.

QUESTIONS AND EXERCISES

1. Illustrate through the use of the fundamental processes of arithmetic how elementary skills are integrated into larger wholes in learning.

2. Elaborate on the idea "neural pattern." What is meant by the "unity of the organism"? What part does the nervous system play in unifying the responses of the individual?

3. Contrast the implications of the words "connections" and "modifications" as they have reference to what happens in the nervous system during learning.

4. Illustrate the statement, "The environment might be conceived of as composed of a series of successive situations to which the individual reacts from the beginning of its life until its death," by observing your own behavior

over a short period of time and noting how one situation leads to another.

5. What is the meaning of the statement that the only way to control the behavior of a child is through a control of its environment?

6. Write a paragraph summarizing the situation-response hypothesis.

7. What difference does it make whether the abilities gained in one situation function in another or not?

SELECTED REFERENCES

1. Benson, C. E., Lough, J. E., Skinner, C. E., and West, P. V. *Psychology for Teachers*, Chap. XIII. Ginn and Company. 1926.
2. Cameron, E. H. *Educational Psychology*, Chaps. VIII and IX. The Century Co. 1927.
3. Carr, H. A. *Psychology: A Study of Mental Life*, Chaps. IV, V, and VI. Longmans, Green and Company. 1925.
4. Dashiell, J. F. *Fundamentals of Objective Psychology*, Chap. XII. Houghton Mifflin Company. 1928.
5. Freeman, F. N. *How Children Learn*, Chaps. VIII and IX. Houghton Mifflin Company. 1917.
6. Gates, A. I. *Elementary Psychology*, Chap. X. The Macmillan Company. 1928.
7. Gault, R. H., and Howard, D. T. *Outline of General Psychology*, Chap. IV. Longmans, Green and Company. 1925.
8. Jordan, A. M. *Educational Psychology*, Chap. III. Henry Holt and Company. 1928.
9. Judd, C. H. *Psychology of Secondary Education*, Chap. XXIII. Ginn and Company. 1927.

10. PERRIN, F. A. C., and KLEIN, D. B. *Psychology*, Chap. V. Henry Holt and Company. 1926.
11. PILLSBURY, W. B. *Education as the Psychologist Sees It*, Chap. VII. The Macmillan Company. 1925.
12. PYLE, W. H. *The Psychology of Learning*, Chaps. I and X. Warwick & York, Inc. 1928.
13. SANDIFORD, PETER. *Educational Psychology*, Chap. IX. Longmans, Green and Company. 1928.
14. STARCH, D. S. *Educational Psychology*, Chaps. VIII, IX, X, and XI. The Macmillan Company. 1927.
15. THORNDIKE, E. L. *Educational Psychology*, Vol. II. *The Psychology of Learning*, Chaps. II and III. Teachers College, Columbia University. 1913.
16. WOODWORTH, R. S. *Psychology*, Chap. XIII. Henry Holt and Company. 1921.

CHAPTER VII

GENERAL PRINCIPLES OF LEARNING

Perhaps in beginning this chapter we should emphasize the fact that the learning process is a unitary one. When we consider attention and learning, interest and learning, repetition, or any other aspect of the learning process, it must always be remembered that this is done because we know of no way yet of studying the learning process as a whole when dealing with concrete situations.

In the previous chapter we dealt with some basic notions fundamental to an understanding of the learning process. In this chapter we shall deal with what might be called the principles of learning. Strictly speaking, several topics treated in the previous chapter might be considered as belonging here. Self-activity is certainly a fundamental principle of learning because the pupil must be active in order to learn. Response is certainly necessary before anything can be learned. Different writers list somewhat differently the laws of learning. The methods of study and the purpose of the writer determine the treatment. Our purpose in this text is to treat the subject in such a way as to give the student an insight into the problems which a teacher meets in trying to secure learning on the part of the pupil. Our treatment will accordingly be different from what it would be had we other purposes in mind.

Trial and error learning. The trial and error method of learning is not a special type of learning. It merely refers to one characteristic of all human and animal learning. In meeting a new or partly new situation the individual may make only one of several responses in attempting to make adjustments necessary for the solution of the problem or difficulty. As the individual tries one response after another, the unsuccessful responses are gradually eliminated until one is found which gives a satisfactory relationship to the situation. If the situation alters but slightly, probably because of previous learning, new adjustments may frequently be made without trial and error.

For example, in drill with simple combinations in addition, a young child was given 3 + 4 after she had previously learned the sum of 1 + 1; 2 + 2; 3 + 3; 4 + 4; 5 + 5; 6 + 6; and 7 + 7. Before these were learned she was tried out on the combinations 2 + 3, 3 + 4, 4 + 5, etc. She was able to guess only one or two of these and rarely guessed correctly the second time. After the foregoing combinations had been learned, she rarely missed a combination totaling less than 14. Her learning experiences with 2 + 2, 4 + 4, etc., seemed to have given her points from which she could work. She had received no drill in subtraction but said that 3 + 4 is 1 less than 4 + 4, or 7. The principle of trial and error did not apply because she had gained sufficient insight or had learned how to proceed step by step until the answer was given.

The combination 3 + 5 was handled in terms of 4 + 4.

Trial and error learning is characteristic of all early learning. Later the student, because of principles and rules which he has developed, may go ahead with his work until the particular thing being learned is mastered. This characteristic of the learning process is found from the simplest phases of motor learning to the most complex types of mental behavior where the individual is dealing with ideas, memories, and other mental processes.

If the student has not had occasion to extract the square root or the cube root of a number for some time, he will find it helpful to do this, since the work will furnish an illustration of how one process after another is tried until the correct one is found. As another illustration of how some method of work is discovered through trial and error, suppose it is required to square 2.5, 3.5, 4.5, and so on for a series of numbers. The squares of course run 6.25, 12.25, 20.25, etc. Many students are able without instruction to develop a method of finding the squares of numbers like these, if they have occasion to do much work of this nature.

Good teaching has definite goals in view. By limiting trial and error methods the teacher facilitates learning. This is brought about by giving definite assignments and making the goals of learning more objective. However, it must not be inferred that children should not be allowed to find out things for themselves through experimentation.

Random movements. Random movements are generally discussed along with spontaneous movements and trial and error learning. We have seen in a previous section that, strictly speaking, there are no spontaneous movements. Using the term as applying to movements made early in life as a result of internal stimulation, we may say that some random movements are a result of spontaneous movements. Random movements are movements — unnecessary for purposes of adjustment — made in connection with responses to situations. Not only are they unnecessary but they may be a hindrance to economical work. Such movements may lead to adjustment but they do not afford the most direct one. An illustration of this fact lies in silent reading. Not only are random movements made but random mental processes also occur. Good methods of learning demand that we learn to select the appropriate responses which lead in a direct way to the solution of problems. "Clear ideas" is a term we apply to a condition in which the mental processes of the individual are not hampered by irrelevant ones unrelated to the things under discussion.

Contiguity. The laws of learning were formerly stated as contiguity, similarity, and contrast. Most writers have reduced these to contiguity alone. First the ideas of contiguity should be stated and then the reasons given why similarity and contrast are no longer included. According to the law of contiguity, when two situations have been experienced together they tend to become associated so that when one is experienced again there is a tendency for the other to be recalled. This law does not always hold, but there is a marked tendency, when two things have been experienced together or in close succession, for either, if experienced again, to revive memories of the other. Similarity and contrast seem to be but special cases coming under the head of the law of contiguity. Two things appear similar only when we compare them, and when they are compared they are experienced together. Thorndike states the law somewhat differently when he tells us in effect to experience together the things which belong together and not to experience together things which are not to be learned in connection with each other. Two things occurring together which have a high degree of similarity or contrast are probably learned more readily on the average than when these conditions are not present.

The law of contiguity not only holds for two processes when occurring together, but it also holds under certain conditions for an occasion when two different kinds of mental processes are taking place. The question can always be raised as to whether the reaction is congruous with other previous mental processes. If not they can hardly occur together. The mere fact that two processes take place in temporal or spatial order is no guarantee of contiguity. However, things so happening are more likely to be associated; yet they may not be. The idea that learning is conditioned by our past experiences is one which is of the greatest importance for the teacher.

Experience and learning. The teacher should frequently ask herself the question: How does this information which the child is to learn fit in with his previous activities? Anything to be learned by the pupil should be so arranged as to be possible of integration into past experience or the particular past experience should be added to until this integration is possible. This is not saying that everything must be made easy or even interesting. It is to be remembered that teaching is not only presenting things to be acquired by the pupil but it sometimes means getting the pupils ready for an experience by first adding to the fund of habits and skills which they already possess so that what is presented can be learned in the best possible way. Teaching has been referred to as the process of manipulating situations so that pupils will react to them in desirable ways. Carrying this idea a little further, teaching would mean the manipulation of both the present and the past experiences of the child in such a way as to secure certain desired results in the child. This is sometimes spoken of as the Law of Assimilation.

Attention and learning. The ability of a pupil to learn depends among other things on how well he can limit his activity to the particular thing to be learned. The ability of a pupil so to limit his reactions is spoken of as his ability to attend. The power of an individual to be active about a problem with his activity limited to that problem indicates a high degree of attention and intelligence. Intelligence and attention cannot be separated. Learning does not take place without both. Strictly speaking, when awake we are always attending to something. If the pupil is inattentive to the class activity this simply means that he is attending to something else which is of greater interest to him.

One of the chief reasons for failure in school is that the children are unable to attend to the tasks assigned. Failure is often due to the inability to concentrate. This is the result of the formation of poor habits or the lack of habits of attending. In his activity the pupil is unable to remain with the problem before him but jumps from one situation to another. We generally speak of such a condition as divided attention. The remedy in a case of this kind lies in training in concentration. Concentration might be viewed as attention in a series of successive situations dealing with the same problem or related problems. When a child concentrates on a problem he attends first to one detail and then to another, disregarding extraneous stimuli. The child who is thus unable to control his attention wanders from situations dealing with the materials under consideration to others which are foreign to them.

Training in concentration can best be given after the pupil has been thoroughly studied. Self-consciousness, lack of self-confidence, poor habits of work, emotional habits, and many other causes which make for poor ability to attend might be enumerated. To correct inattention the cause must first be found. Frequently activities other than those of the school seem more worth while to the pupil.

In a case of this kind the outside interest must be located and an effort made to relate school work to the interest in some way. Where the pupil has a lack of self-confidence or is self-conscious, practice in attending should be afforded under proper conditions. The ability to concentrate must be considered from the learned viewpoint as well as from the hereditary. Definite practice must be provided if the pupil is to develop this ability which is considered one of our most important educational outcomes. Before providing situations for the purpose of developing the ability to concentrate, the teacher should find what interests the pupil already has. These interests should be utilized in school situations to the fullest.

The ability to attend is itself a growth. The young child is able to attend but for a short period of time. As he comes in contact with people and things he gradually builds up such habits that by the time he reaches school he has acquired the ability to attend to a number of things for a longer period of time. In most cases he, at this stage, gives attention primarily to those things which are of more immediate interest and that have to do with the satisfying of his original desires. The school must take him with his abilities developed as they are and carry them further by building up habits of concentration over a longer period of time and for problems which have no immediate goal. In other words, the school helps the child form the habit of giving attention to problems which have more remote rewards as well as to those which have immediate ones. The ability to give attention to more remote goals is a sign of good training.

Attention, interest, and learning. Attention and interest cannot be separated. Interest is dynamic and determines to what we pay attention. Interest is the feeling side of the reaction to which we give the name attention. Things which we can do, which fit into our previous experience, which are in harmony with our innate tendencies are said to be interesting. Interest and attention have been classified in many ways. For practical purposes they may be classified as original or acquired. A similar classification is sometimes made, using the terms "primary," to denote original interests, and "secondary," to denote those acquired. As stated elsewhere, the difference between original and acquired behavior must be considered as one of degree only. Strictly speaking all acquired behavior must also be considered original in that it develops out of hereditary potentialities. Acquired interests and ability to attend grow out of original ways of reacting which we call primary interest and attention.

Primary interest and attention are always but parts of a reaction to the same situation. These different aspects of the same behavior of an individual toward the same thing cannot be separated in reality. The person reacts in a unified way toward a situation which arouses behavior. Only for purposes of analysis may we separate attention and interest. Things which are originally interesting receive primary attention. In like manner, things to which we spontaneously attend are of primary interest.

Originally, only those things to which man has inherited a tendency to respond are given primary interest and attention but, as learning takes place, we build habits of interest and attention which are aroused by various situations. We are frequently unable to see in the child or adult any connection between acquired behavior and original behavior. The interest in a subject may have been built up in a very roundabout way. Interest in a situation which is apparently very remote from one to which the child reacts in a primary way may become as dynamic as were the primary interests out of which it grew. As learned behavior becomes more and more habitual it tends to take on all the characteristics of original behavior. Thus secondary attention and interest tend to become as potent for behavior as primary.

If we expect the pupils to be interested in the work of the school the problems must be connected with their primary interests either original or acquired. Generally, it is relatively simple to connect school work with things in which the pupils are already interested. Except to pupils who have had training of a very inferior nature, most problems have points of interest to which the child will respond with primary interest and attention. It is the business of the teacher to find these points of interest for each child and connect them appropriately with the work of the school.

Practically all pupils reach stages in the learning of any subject where the materials become dull and uninteresting. This often happens because children have a tendency to work at the most interesting things first and neglect problems less interesting. The teacher can be of great help at this time by giving new incentives for work, by providing new methods of approach, by enlarging the horizon of the pupil through the use of additional materials. The teacher should watch for signs of the lagging of attention and interest. Pupils should be trained to take an interest in completing a task in a thorough way. If this is done attention will be given to uninteresting parts of the task because of interest in producing a completed assignment.

Previously it was stated that secondary attention tends to become primary under certain circumstances. Not only does the teacher desire that the pupil build up habits of knowledge and skill but also habits of feeling with respect to the things taught. Learning takes place under the most favorable conditions when the pupil has reached a point in his training at which secondary attention and interest tend to take on the characteristics of primary. In this stage of his education, things which formerly required effort for concentration and which had to be motivated in various ways by the teacher now become so inherently interesting as to need no outside motivating factors. The pupil who concentrates on the work of the school because he has reached a point in his training where this is made possible through interest spends not less effort but more. The effort here, however, has more direct bearing on accomplishment because it is not spent in useless ways. One of the first tasks of the teacher, in point of importance, is to train pupils so that they will develop an inherent interest in the work of the school.

Attention and interest as an end in education. One of the aims of the school should be to develop the ability to give voluntary, or secondary, attention. The child must not only be trained so as to have a large number of interests but he must be so trained that he is able to attend to the various problems he meets in life and to secure pleasure in their successful solution. This does not mean that the child must be forced to attend to a number of hard tasks for the purpose of receiving training in concentration. It does mean that the child must learn to find joy in being able to meet difficult situations in life and to master them for some worth-while purpose. He must learn to find interest in any problem which is related to the larger aims he has in working. Pupils should be so taught as not to expect to find situations dull and uninteresting but stimulating and full of unknown possibilities which are to be related to larger purposes.

Immediate aims are overemphasized in school to the neglect of more remote ones. In order to be ultra-practical our schools are too prone to emphasize minor and present relationships to the neglect of larger and more general ones. The school is thus likely to turn out pupils who have a narrow, cramped vision as to themselves and their relation to the problems of everyday life. To train pupils to be interested in a problem not because it is easy or hard but because it is worth while and because its solution leads toward some worthy goal is a task which is deserving of the teacher's best efforts.

The ability to concentrate so as to secure information must not be overlooked as an educational objective. Too often we are so much concerned with the materials to be learned that we lose sight of the fact that training means habit formation for which the materials are chiefly useful in that they furnish opportunities for pupil activity which leads to habit. To develop the ability to find interest in one's task and to give forced attention to a problem because some relationship can be seen between it and a more remote goal is a worthy undertaking in itself. Too much emphasis cannot be placed on the fact that education consists in acquiring such abilities. The school should take as one of its chief tasks the training of pupils in the habits of concentration as far as the native equipment of the pupils will allow. Habits of interest and attention are ends in themselves as well as means to other desirable educational objectives.

Not only should pupils be trained to have a large number of interests but also to have good habits of giving attention and building up interests. Often when a pupil has seen a new point or relationship in a situation the work of the school is so organized that it breaks into the activity which is thus taking place. Also the method of the teacher in securing interest and attention may be of the poorest type. A good teacher directs the work of the school in such a way that the pupils are alert and understand the directions and instructions the first time they are given. Giving directions to children over and over or repeating questions encourages slovenly habits on the part of the pupils. One type of training in secondary attention and interest is to teach pupils to expect questions, directions, and assignments to be given once only. Pupils frequently give little attention because they know that the teacher will repeat a number of times. Unless directions are too long and complicated, pupils should be expected to get them the first time they are presented. If repetition is necessary, it should not be for the sake of giving the children another chance to pay attention but for the sake of clarification and insight.

The span of attention and learning. Teachers are coming to recognize more and more that the most important element in the teaching situation is a knowledge of the human organism which is being taught. In presenting any material of instruction to children an important fact to know is the span of attention for children of that particular age and how children differ in this trait. Table XIX shows the span for digits for children of different ages. It will be noticed that for this type of material the span of attention is much less for young children than for older. For other types of material the same ratio probably does not hold, but there are large differences. In presenting material to children, whether oral or written, the span of attention must always be considered. Materials should be so broken up and grouped as to be apprehended by the pupils.

TABLE XIX. SHOWING SPAN FOR DIGITS FOR CHILDREN OF DIFFERENT AGES[1]

AGE	8	9	10	11	12	13	14	15	16	17	18
No. Cases	8	13	19	36	41	42	47	72	66	50	30
Average Span	6.6	6.7	6.8	7.2	7.4	7.3	7.3	7.7	8.	8.6	8.6

An untrained teacher is apt to overlook differences which exist between the pupils and herself. Kennedy-Fraser[2] calls attention to the fact that children pay more attention to the words used in giving directions than do adults. Adults tend to pay attention to the meaning of a statement while the child attends to the words used. By attending to the meaning the older child or adult is thus able to grasp much more than the younger child who attempts to remember the specific words. This tendency on the part of the younger pupil, together with his shorter attention span, makes it difficult for him to grasp instructions and materials which the older readily understands. The work of the school must be so arranged as to be capable of being apprehended by the child for whom it is intended. However unpsychological it is to give materials in such a way as to be beyond the abilities of the child, oversimplification is equally bad. The writers have known teachers who underestimated the abilities of their pupils and who consequently, in presenting materials, oversimplified the matter, thus developing poor habits of attention and a feeling that the work of the school was mere play and unworthy of one's best efforts. A teacher should study the abilities of the children and plan the activities accordingly.

---

[1] Whipple, G. M. *Manual of Mental and Physical Tests, Complex Processes*, p. 172. Warwick & York, Inc. 1915.

[2] Kennedy-Fraser, David. *The Psychology of Education*, p. 65. Methuen and Co., London. 1923.

Perceptual learning. This topic refers chiefly to the child's learning in its earlier stages. The infant is born with sense organs which make it possible for him to receive stimulation both internally and from the things about him. The nature of the world of the infant is a fascinating topic. How things appear to him we do not know because our earliest experiences are lost to memory. However, we know from the observation of children that the child very early begins to distinguish persons and things about him. He begins to select moving and bright objects from what probably appears as a general vague background and he reacts to these. Gradually, he learns to distinguish persons from things. As he grows older these specific situations acquire more and more meaning for him, so that by the time he is able to walk many of the objects in his immediate environment have meaning for him. Also things have become more or less localized and he has built up an elementary notion of distance and time.

Perceptual learning also refers to acquirements in more complex and artificial situations, that is, in situations which have been especially arranged in order to give the child an opportunity to react to materials. Much of the experimental literature treats of perceptual learning because the learning of new materials presented to the individual through the sense organs is studied more easily than learning involving the reorganization of materials already learned. Learning which involves the manipulation of ideas, memories, and similar thought processes is generally called associative learning. Economical methods of learning discovered in experiments on perceptual learning undoubtedly apply to associative learning as well, since there is no essential difference between the two.

Instincts and learning. All learning is based directly or indirectly on original ways of reacting. These original ways of acting are generally called instincts. In order to clarify our ideas concerning the relation between instinct and learning, a definition and a discussion of instincts are given here. The term instinct is used in this text with the following meaning. An instinct is an inherited tendency to react more readily in certain ways than in others, when certain situations are present. It must be considered merely a tendency to act. Because of the structure and constitution of the organism it is able to react more readily in certain ways than in others. Should the appropriate stimuli not be present, the organism will develop ways of reacting which are less characteristic. Thus the reactions themselves must be considered as learned. Instinctive acts are not perfect at first but are made so through practice. It is very hard to separate instincts from early acquired habits. In fact, for practical purposes it is doubtful whether the attempt is worth the effort. For scientific purposes, however, it is highly desirable that we know just what the child has received from his heredity and what from his environment during the first year of his life. Habits are more secondary, that is, are built upon instinctive activity. Instincts in contrast might be considered primary since they are regarded as original tendencies to activity when certain stimuli are present.

In studying instincts we often contrast those possessed by children and those possessed by lower animals. The instincts of lower animals seem to be more definitely fixed than those of man. If we consider only fixed responses, the child is much more poorly equipped at birth for survival than are the young of most other animals. However, if we consider the number of inborn tendencies to react in fairly definite ways to various stimuli, the child's instinctive heritage is enormously richer and more complex than that of any other animal. It is sometimes dangerous to apply facts learned in studying one species to the behavior of another. We should distinguish between the less modifiable instincts of the lower animals and the more modifiable ones of man. The inborn tendencies of man are just as much a result of his heredity as are the inborn tendencies of lower animals of their heredity, but in man they differ in being less fixed and capable of great modification.

Since man's instinctive heritage is modifiable, it is often hard to distinguish between instinct and habit. Different workers furnish lists of instincts which are so unlike as to be hardly comparable. All psychologists probably agree that there are inborn tendencies to feel and act in certain ways when the organism is confronted with certain stimuli, but, when an attempt is made to catalogue these tendencies, wide differences of opinion are revealed. Thorndike[1] calls attention to the fact that man's original responses may be classified in several ways. The purpose of the writer will largely determine the grouping. Thorndike's[2] list, which is one of the best and is widely quoted, is arranged in terms of responses as follows:

1. Those resulting in sensitivities.
2. Those resulting in attention.
3. Those resulting in gross bodily control.
4. Those resulting in food-getting and habitation.
5. Those resulting in fear, fighting, and anger.
6. Those resulting in human intercourse.
7. Those resulting in satisfaction and discomfort.
8. Those resulting in minor bodily movements and cerebral connections.
9. Those resulting in the emotions and their expression.
10. Those resulting in consciousness, learning, and remembering.

Attention should be called to the fact that a given situation might call for a response including a number of the responses listed above. For instance, no situation would call for attention alone.

---

[1] Thorndike, E. L. *Original Nature of Man*, pp. 11, 12. Teachers College, Columbia University. 1913.

[2] *Ibid.*, p. 43.

Instincts might also be classified in terms of situations which call for original behavior. In this case the instinct would be named according to the situation calling forth the behavior. In one sense man's total environment might be classified into somewhat similar situations which call for somewhat similar responses. "Instinct" refers to the fact that man has inherited a tendency to learn more readily how to react to certain situations one meets in life than to others.

A most important principle in education is to make use of these inherited ways of reacting which include interest, attention, emotion, motor behavior, and so on. These are generally spoken of as primary interest or as primary or spontaneous attention. We have no similar terms for inherited forms of motor behavior. The term instinct itself is used by some writers to denote original motor behavior while the term emotion is used so as to include the corresponding mental behavior. It must be remembered that in thus speaking of behavior we are not implying that there are two kinds of behavior. Mental and motor behavior are but two aspects of the same thing, namely, the attempt of an individual to adapt itself to stimuli.

Habit and learning. The relationship which exists between habit and learning may be considered from two points of view. How have habits been acquired? And, after certain habits are fixed, how do they condition further learning? In regard to the first question, habitual behavior has been built upon instinct in accordance with the principles of learning. Through activity characterized by the trial and error phenomena and because of the operation of the laws of habit fixation — contiguity, assimilation, recency, frequency, intensity, etc. — the individual gradually develops a rather stable response to a situation to which his original behavior in itself is unable to make adequate adjustments. Thus habits are developed because man's inherited modes of responses are often inadequate in making adjustments. Habits are built upon, or rather develop out of, more primitive responses. In the case of habitual movements, as walking, they grow out of so-called random and spontaneous movements. Movements in walking are at first made with great effort. If the child is walking and some other situation is presented to which he reacts he immediately, unless the process is well on the way of becoming merely a mechanical one, loses control of the coördinations necessary for walking and sits or falls down. Gradually, the coördination becomes so firmly established that he is able to direct his attention to other things and at the same time continue to walk.

Habit, however, must not be considered as purely motor. There are many mental ways of behaving which become as firmly established and as uniform in response as physical habits. How one regards himself, the confidence he has in himself, his independence of thought, his freedom from bias, his sensitiveness to the opinions of others, and many other habits might be listed. In fact, one's success or failure in life is largely a result of such habitual ways of reacting. Certain characteristics which we admire, as open-mindedness, fairness, good methods of studying, are habitual.

Habits are important in that they free the individual for higher types of responses. As an individual goes through life, habits are gradually built which make for adjustment in a fairly automatic manner, leaving the individual free to attend to new situations and to develop habitual methods of meeting these. In this way habits come to be built upon habits. Elementary processes which have become habitual constitute, together with instinctive behavior, the foundations upon which other habits are laid. In language the child goes from words and phrases to whole statements. Mental habits may become very complex in that they consist of an organization and development of many more simple ones.

Not only is it important that the teacher understand the principles of habit formation in order to arrange the learning process so that habits will be formed in the most economical manner, but she must understand the part habit plays in the life of the pupil. Habits may not only be helpful and of advantage to the individual, but they may be harmful and inhibitory of progress. Education is largely concerned with the guidance of the individual into the kinds of habits which will lead to greater development. It not only includes the development of habitual interests, habits of concentration, and others which make for growth along definitely selected lines, but education must see that habits which make for close-mindedness, prejudices, and similar undesirable attitudes which make for the *status quo* in an individual's life are not developed. In general, all forms of propaganda have as their goals the shaping of an individual in a certain way which the propagandists desire. The teacher must guard against such influences in the school because they generally make for habits of close-mindedness. There is a tendency for pupils to regard the materials given by the teacher or the text as final. The students should be taught in such a manner as to develop habits of first examining and evaluating materials before accepting them. Teachers should not fall into the habit of regarding their own opinions as final or authoritative. Only facts based on experimental evidence should carry the weight of authority.

The goal of habit formation, then, is to help the individual acquire control of himself so that he will react to a larger and larger number of life's situations in a habitual manner and at the same time see that the acquirement of these habitual modes of behavior do not condition him in such a way that he is no longer able to continue to modify his actions. Habit formation for growth and modifiability should be the aim of education. The method of attaining this goal lies in the formation of no habits which will prevent the formation of other desirable ones. Habitual interests, self-examination for prejudices, habits of examining assumptions, and habits of a similar nature are just as important for growth as many of the more definite ones for which we have extended drills in school. The habit of forming habits is a worth-while objective of education.

Frequency and learning. The relation of the frequency of a response to learning has generally been stated as a law which assumes that learning is proportional to the number of times the thing to be learned is repeated. The explanation of the common assumption that repetition tends to fix a response lies not in the fact that mere repetition causes a fact to be learned but rather that, when a situation is reacted to again and again, opportunities are presented for integrating the present experience with former experiences. Repetition itself probably has nothing to do with learning. On the other hand, to react a second time to a situation does provide an additional opportunity for the assimilation of the reaction in terms of those made earlier. During repetition the learner is frequently made to add to former experiences in order to have a basis with which the present ones are linked. This is an important fact and here the teacher can be of great help to the pupils by seeing that the proper basis has been provided for drill work.

All this of course is not an argument against drill. Drill is highly valuable but the emphasis must be shifted from mere repetition to an active search for relationships. These relationships are to be found in the materials already learned. The teacher is charged with the duty of providing sufficient drill, but the exercises must not be mere blind mechanical processes. The ability of pupils to gain an insight into the total situation into which the drill materials will fit is necessary and teachers must be sure that the students have a sufficient background of experience before any drills are undertaken.

Recency, intensity, and primacy. These factors are almost always listed as laws of learning. They are undoubtedly fundamental as secondary laws. The law of recency states that if a number of things have been experienced with let us say a certain object, other things being equal, the one most recently experienced with the object will be recalled when the object is presented again. The law of intensity on the other hand states that, all things being equal, the one experienced with the object in the most intense way will be recalled. The law of primacy holds that under similar conditions, that is, other factors being equal, the thing will be recalled which was first experienced with the object.

It is not to be concluded that learning at one time is primarily a result of one law, at another time of another, and so on. These factors probably never operate entirely independently of each other. They must always be considered as only special aspects of experience. The danger for the teacher lies in the fact that these factors are often considered as special laws of learning and emphasized without due regard to the integration of the present experience into that of the past. The individual is a unit in behavior, and material to be learned must be considered not in the light of some special aspect of experience but in its totality. When any special aspect of learning is used for purposes of quick learning, the goal must determine what further is needed. If the learning is for temporary purposes, special devices are probably justifiable, but if it is to be permanent or to function in many situations, insight into additional relationships must be developed. This means connecting the thing to be learned with larger wholes. For illustration, a poem may be learned because it is suitable in the introduction of a speaker at a dinner, but if it is to be retained and made useful in general, it must be made to fit into a larger relationship.

Forgetting. In terms of amount, forgetting takes place rapidly immediately after a thing has been learned and more slowly as time goes on. The experiments which have been made by Ebbinghaus, Lyon, Cuff, and others dealt with nonsense syllables or other materials which had little relation to the general environment of the subject. Consequently, materials learned in the experiments did not take on that warmth of meaning which is acquired when things are learned because there is a general need for them. Forgetting under such circumstances would probably be more rapid but the results secured should apply in general to situations in which sense material is learned. Ebbinghaus[1] found that he forgot approximately 42 per cent of learned nonsense material in 20 minutes, 56 per cent in 60 minutes, 66 per cent during the first day, and 79 per cent during an interval of 30 days. Cuff,[1] using a large number of subjects, found that no general statement could be made as to the amount which a subject would forget. Intelligence and other factors enter into the process of forgetting as well as into the process of learning. Undoubtedly, however, materials which have little relation to the child's everyday experiences and for which it is hard to develop meanings are forgotten more rapidly than those which are more in line with his common experiences and which carry meanings. Materials are probably never entirely forgotten. In the case of nonsense syllables, all the syllables may apparently be lost to memory and yet the individual remember the experience he had in memorizing them. However, even though the experience seems completely lost to memory, it probably is not lost completely to the organism in that all later adjustments are in part conditioned by earlier. An experiment dealing with nonsense syllables need not be remembered at all in the sense that the organism can consciously recall any of the events connected with the experiment, yet such an experiment would without doubt influence one's attitude toward experimental work in general. In the main, our attitudes, purposes, ideals, and so on are the results of many experiences most of which we are now unable to recall.

---

[1] Ebbinghaus, H. Uber das Gedachtness. 1885. Translated by Ruger, H. A. Teachers College, Columbia University, *Educational Reprints*, No. 3. 1913.

---

[1] Cuff, Noel B. "Relation of Overlearning to Retention." George Peabody College for Teachers, *Contributions to Education*, No. 43. 1927.

Forgetting is of value in the learning process. It is well that many of the details of our experiences are forgotten. Only those things are remembered which are definitely integrated into the past experiences of the individual. This may or may not be of a conscious nature. If it were not for forgetting, the individual would be hampered by being compelled to attend to an endless multitude of unimportant details.

QUESTIONS AND EXERCISES

1. Visit a class in handwriting in the lower grades. Do you find examples of trial and error learning?
2. List other examples of trial and error learning which you have found in your observations in the elementary grades. Give illustrations from your own experiences which show trial and error learning.
3. Illustrate the point that similarity and contrast may be treated as special cases of contiguity.
4. In visiting classes in the elementary grades observe and record instances of perceptual learning.
5. Illustrate from observation in the elementary grades the method used in beginning a new subject or topic. Were the existing interests of the children considered?
6. Name ten things in which it is desirable that children develop permanent interests.
7. Select two texts in general psychology and contrast the lists of instincts given.
8. Illustrate the rôle of habit formation in the development of the efficiency of an individual.

9. Many educators speak of learning through self-activity. Try to determine just what is meant by such a statement as "learning should be based on the self-activity of the child." Does the statement imply that learning might take place through some other type of activity?

10. State in a few words what is meant by insight. Does it mean the same thing as sensing relationships? Give a situation in which a child in dealing with a school problem apparently grasps the significant elements or has insight.

11. Why is it important to inventory the experiences of beginning children before attempting to guide them in learning? Do you get an idea of what is meant by experience? Attempt to state orally just what the term means to you.

12. Illustrate why attention and interest should be considered an educational objective as well as a means to an end.

SELECTED REFERENCES

1. BRONNER, AUGUSTA F. *The Psychology of Special Abilities and Disabilities.* Little, Brown and Company. 1923.
2. BOOK, W. F. *Learning How to Study and Work Effectively.* Ginn and Company. 1926.
3. BROWN, A. W. "The Unevenness of the Abilities of Dull and Bright Children." Teachers College, Columbia University, *Contributions to Education,* No. 220. 1926.
4. BURT, CYRIL. "The Distribution and Relations of Educational Abilities," *The London County Council.* P. S. King and Son, Limited. 1917.

5. Child, C. M. *The Origin and Development of the Nervous System.* The University of Chicago Press. 1921.
6. Child, C. M. *Physiological Foundations of Behavior.* Henry Holt and Company. 1924.
7. DeVoss, J. C. In *Genetic Studies of Genius*, edited by L. M. Terman, Chap. XII, "Specialization of Abilities of Gifted Children." Stanford University Press. 1925.
8. Gates, A. I. *Elementary Psychology.* The Macmillan Company. 1925.
9. Herrick, C. J. *Neurological Foundations of Behavior.* Henry Holt and Company. 1924.
10. Hincks, Elizabeth M. *Disability in Reading and Its Relation to Personality.* Harvard University Press. 1926.
11. Kincaid, M. "A Study of Individual Differences in Learning," *Psychological Review*, Vol. XXXII, pp. 34–53. 1925.
12. Parker, G. H. *The Elementary Nervous System.* J. B. Lippincott Company. 1919.
13. Perrin, F. A. C., and Klein, D. B. *Psychology: Its Methods and Principles.* Henry Holt and Company. 1926.
14. Peterson, J. "Completeness of Response as an Explanation Principle in Learning," *Psychological Review*, Vol. XXIII, pp. 153–162. 1916.
15. Pillsbury, W. B. *Education as the Psychologist Sees It*, Chap. XII. The Macmillan Company. 1925.
16. Romanes, G. J. *An Examination of Weismannism.* The Open Court Publishing Company. 1899.
17. Ruger, H. A. "Psychology of Efficiency," *Archives of Psychology*, No. 15. 1910.

18. Spearman, C. *The Nature of Intelligence and the Principles of Cognition.* Macmillan & Company, Limited, London. 1923.
19. Spearman, C. *The Abilities of Man.* The Macmillan Company. 1927.
20. Strong, E. K. *Introductory Psychology for Teachers.* Warwick & York, Inc. 1922.
21. Strong, E. K. "The Learning Process," *Psychological Bulletin*, Vol. XIII, pp. 339–343. 1918.
22. Thompson, Godfrey H. *Instinct, Intelligence, and Character.* Longmans, Green and Company. 1924.
23. Thorndike, E. L. "Intelligence and Its Uses," *Harper's Magazine*, Vol. CXL, pp. 13–32. 1919.
24. Thorndike, E. L. *Educational Psychology, Briefer Course.* Teachers College, Columbia University. 1914.
25. Woodworth, R. S. *Dynamic Psychology.* The Macmillan Company. 1918.
26. Woodworth, R. S. *Psychology: A Study of Mental Life.* Henry Holt and Company. 1921.

CHAPTER VIII

SPECIAL ABILITIES AND DISABILITIES IN LEARNING

The problem of general and special abilities. The question as to whether a person's sum total intellectual endowment is composed (1) of a general ability which may function in many ways, or (2) of a number of specific abilities each of which functions in a more specific way, or (3) a general ability plus numerous specific abilities is of practical importance. Spearman[1] has maintained that there is a general factor which enters into all performances plus a specific factor for each particular performance. This is known as the two-factor theory. On the other hand, Thompson [2] and others have taken the position that abilities are specific and have denied that a general factor exists. Thompson calls attention to the fact that Spearman's general factor represents that part of one's ability, the general level of abilities, from which the special abilities seem to rise. However, as he thinks, this general level merely represents the general correlation that one would expect to find between all of an individual's many different abilities.

Most if not all of our tests of mental ability attempt to find a kind of average for an individual's abilities. Thus, in the Binet-Simon Scale the tests are selected so as to test a large number of abilities. As a rule, success on one test of the scale is worth as much as success on another. The scale more or less finds an average of the various abilities of the child examined. The I.Q. is to be considered as a measurement of a large number of abilities. It is not to be considered as a measurement of a single ability. Two children therefore who have the same numerical I.Q. may have and often do have quite different abilities. Most intelligence tests do not, however, attempt to measure all abilities but are constructed so as to measure what might be called school intelligence. Since this is true, children with the same numerical I.Q. may not vary so widely in school intelligence as they do in other abilities not measured by intelligence tests.

---

[1] Spearman, C. *The Nature of "Intelligence" and the Principles of Cognition.* Macmillan & Company, Limited, London. 1923.

[2] Thompson, Godfrey H. *Instinct, Intelligence, and Character.* Longmans, Green and Company. 1924.

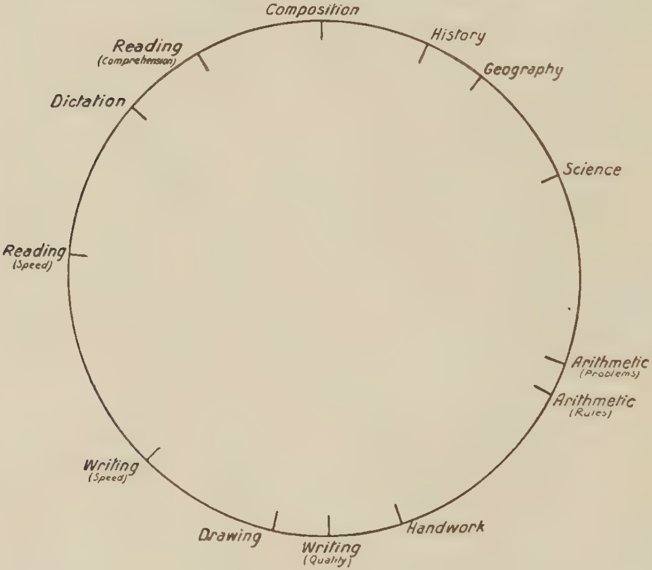
The meaning of special ability. When any number of tests are given to a group of children, they will as a rule show wide differences in ability on the various tests. Not only will the group as a whole show differences in the various tests, but from test to test the individual will show differences. Thorndike[1] states that the total range of man's abilities may be listed under three types: abstract, mechanical, and social. In a similar way Burt[2] has named four groups of abilities determined on the basis of degree of correlation. He lists an arithmetic group; a manual group composed of handwork, drawing, and writing; a linguist group composed of reading and dictation; and a group composed of history, geography, science, and composition which he calls the composition group. The last two groups seem to be more closely related to each other than to either of the others. Figure 5 is used by Burt[1] to illustrate the relations he found be-

---

[1] Thorndike, E. L. "Intelligence and Its Uses," *Harper's Magazine*, Vol. 140, pp. 13–32. 1919.

[2] Burt, Cyril. "The Distribution and Relations of Educational Abilities," *The London County Council.* P. S. King and Son, Limited. 1917.

FIGURE 5. TO ILLUSTRATE THE SPECIFIC RELATIONS BETWEEN THE CHIEF SUBJECTS OF THE SCHOOL CURRICULUM



---

[1] Burt, Cyril. *Op. cit.*, p. 59.

tween the chief subjects of the school curriculum. Brown,[1] in a rather thorough study which summarized the work of others as well as his own, found that abilities could be grouped in terms of the degree of correlation. His data seem then to confirm the position of Thorndike and Burt.

From the viewpoint of training, individuals may be looked upon as made up of a large number of habits, attitudes, feelings, and the like. To say that two pupils have such a special ability in a school subject as to cause them constantly to score twenty or more points higher in that subject than in other subjects which are not closely related to it does not mean that the special ability of the one pupil is the same as that of the other. In other words, special abilities cannot be considered as either simple biological mechanisms or as simple processes resulting from environmental influences. Special abilities or disabilities, apart from general intelligence, should be considered as a group of good or poor habits, attitudes, and interests, built of course upon inherited factors. These factors probably may in turn be general or more specific, or both. Thus, if ability in music is based partly upon good auditory imagery and memory, a person possessing these inherent characteristics may have developed such habits, skills, attitudes, and interests that we now say that he has special ability for music.

---

[1] Brown, A. M. "The Unevenness of the Abilities of Dull and Bright Children," Teachers College, Columbia University, *Contributions to Education,* No. 220. 1926.

A person who has apparently good ability for a subject at one time may at a later period appear not to have equally good ability for the subject because the subject is really not the same. In other words, mathematics in the early grades is a vastly different subject from mathematics in the university. As one progresses from the grades to the university his habits which made him fail or succeed in early years may change. The same inherent ability is present but the way in which that ability functions may have changed; that is, the attitudes and habits which have been built upon it in later years may be different from those of earlier.

Causes of special abilities and disabilities. The work of Mendel, Weismann, and others in the field of genetics during the nineteenth century very profoundly influenced thought concerning ability. From Mendel's[1] experiments the theory that heredity is a question of unit traits was developed. He showed that in garden peas certain traits were passed on to the offspring as a unit. From this and other investigations it was inferred by a number of workers dealing principally with the feeble-minded that intelligence is inherited as a unit trait. We know now that mental ability is not inherited according to the "all or none" principle. In any measurement of the abilities or activities of children we find a continuous series of degrees of ability. If intelligence were inherited as a unit, we would expect to find at least two distinct groups of children with respect to that trait.

---

[1] Romanes, G. J. *An Examination of Weismannism.* The Open Court Publishing Company. 1899.

Today the importance of environmental influences in the development of hereditary potentialities is generally recognized. It is impossible to separate in any special ability or disability the hereditary and environmental factors. That is to say, we are unable satisfactorily to separate habits and original potentialities which make for superior or inferior functioning in a given situation. For practical purposes, however, it is unnecessary to assign definite amounts of influence to each of these two factors. With respect to special disabilities a partial list of causes might be given as follows:

I. Environmental
    a. Causes which result in poor attendance at school
    b. Causes which make for poor physical development
    c. Causes which make for poor habits of study
    d. Causes which emphasize certain of the subjects to the neglect of others
    e. Causes which make for wrong emotional conditioning, loss of interest, etc.

II. Genetic
    a. Poor hereditary potentialities
    b. Poor physical condition
    c. Specific physical defects
    d. Temperamental defects

It is needless to state that the causes here listed constitute an inadequate survey. The list is merely given as a suggestive one. A study of the case histories published by Bronner,[1] Hincks,[2] and others shows the difficulty of disentangling environmental and hereditary factors as specific causes of superior and inferior ability.

Unevenness in ability of bright, dull, and average children. Several studies have been undertaken to discover whether special groups of children differed in unevenness of ability. DeVoss[3] compared 100 bright children with approximately the same number of unselected pupils to find whether the one group was more highly specialized than the other. Brown[4] gave tests to 456 children of ten, eleven, twelve, and thirteen years of age. Two groups of children, one dull and one bright, were selected from these. Similar results were obtained in each experiment. Little difference was found between groups. While marked differences in unevenness were found between individuals, no significant differences between groups were found. DeVoss states that general ability as measured by the Stanford Revision of the Binet-Simon Scale has more to do with success in school than any special ability measurable at the present time. It might be stated, however, that the tests for measuring the special abilities required for mastering a school subject are few and probably not so reliable as the Binet-Simon.

---

[1] Bronner, Augusta F. *The Psychology of Special Abilities and Disabilities.* Little, Brown and Company. 1923.

[2] Hincks, Elizabeth M. *Disability in Reading and Its Relation to Personality.* Harvard University Press. 1925.

[3] DeVoss, J. C. In *Genetic Studies of Genius,* edited by L. M. Terman, Chap. XII, "Specialization of Abilities of Gifted Children." The Stanford University Press. 1925.

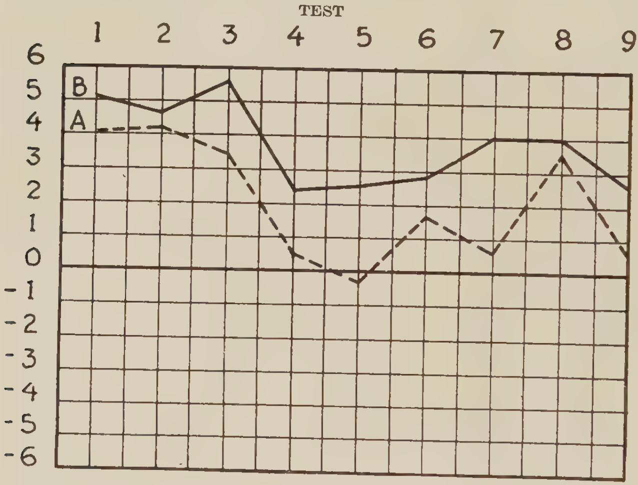
[4] Brown, A. W. *Op. cit.*

Success or failure and special abilities. It is obvious that the type of special ability a child has or will have, as well as the level of his general ability, will determine the success or failure of the child in his adjustments to the environment. Should the environment be such as to emphasize the abilities a pupil possesses, he will probably develop in a desirable way. If abilities which are present only in a small degree are demanded, the child will be unable to make adequate adjustments and as a result will develop in undesirable ways. Much success in life is undoubtedly due to the fortunate condition in which the child finds need for the special aptitudes he possesses. On the other hand, much misery, failure, and probably delinquency are the direct result of demands on the part of the environment to which the child is unable to respond adequately because of the lack of some special ability. Children may, and as a matter of fact often do, possess types of abilities for which the school makes little or no provision. Under such conditions the child becomes a misfit in school or a problem case. It is evident that by not providing for all types of abilities the school contributes directly to development which may be anti-social.

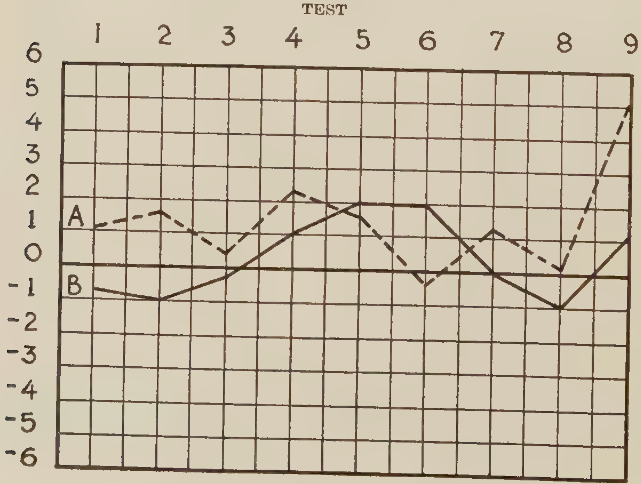
Burt used graphs which he calls "psychographs" in comparing the abilities of individual children in the school subjects. Figure 6 gives psychographs

FIGURE 6. SHOWING PSYCHOGRAPHS FOR THREE CHILDREN

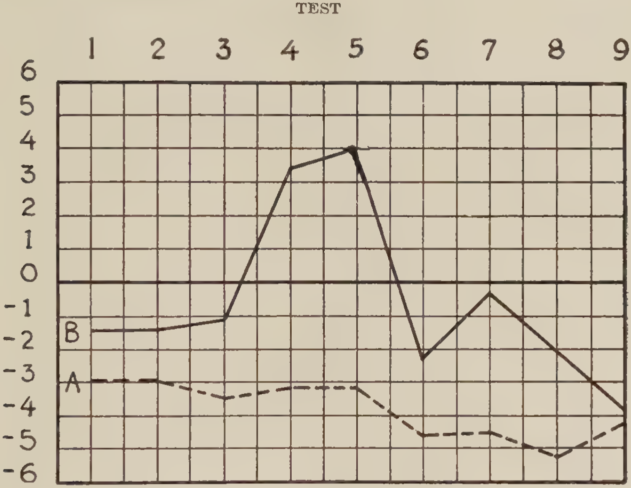
Pupil 1, I.Q. 107, Boy



Pupil 2, I.Q. 103, Girl



Pupil 3, I.Q. 114, Girl



Test 1. Reading: Paragraph Meaning
Test 2. Reading: Sentence Meaning
Test 3. Reading: Word Meaning
Test 4. Arithmetic Computation
Test 5. Arithmetic Reasoning
Test 6. Nature Study and Science
Test 7. History and Literature
Test 8. Language Usage
Test 9. Dictation Exercise

for three children. These graphs have been selected from a large number on file in the Jesup Psychological Laboratory. The graphs lettered A show the standard scores made by the three pupils at the middle of the fourth grade on the Stanford Achievement Tests. Those lettered B are based on scores made three years later at the midpoint of the seventh grade. Pupil 1 gained during the interval in all the school abilities measured but his graphs are very similar. We may think of this pupil as having about average intelligence and as being motivated somewhat better than the average pupil. Probably the low scores in the arithmetic test indicate not a lack of ability but poor teaching. Graph B shows that this pupil improved his ability in arithmetic from the fourth to the seventh grade. Very likely under different teaching conditions his arithmetic scores would have been as high as his reading scores.

Pupil 2 has average ability and does about average work; however, her two graphs are somewhat dissimilar. They are more even than we have found on the average. We may think of this girl as possessing average ability and as being as well motivated as the average pupil. At the first testing she did unusually well in test 9 (spelling) but at the second her record was about the average.

Pupil 3 has ability which would place her among the best 25 per cent of the pupils. However, at the first testing she was doing work quite below the average. At the second testing she was still below the average on all the tests except 4 and 5 (arithmetic tests). In these she scored unusually high. Had we no record of this pupil except the last, it would appear that she possesses special ability in arithmetic. However, in this particular case the pupil was working at a low level of achievement because of lack of interest in the other work of the school. The school is organized on the departmental plan and she is interested in her teacher of mathematics. Her good score in arithmetic is very likely a result of this motivation.

Children vary enormously in growth in the school subjects. Owing to particular social, psychological, or other conditions, the school may be using a standardized procedure with each child rather than with the group as a whole. While this method is doubtless to be preferred to no individual instruction the emphasis is on standardized methods derived from work with the so-called normal child. The moment uniform procedures are introduced, we may be sure that the teacher has studied methods rather than children. Individual instruction should mean that each child has the opportunity to be working at definite tasks provided with his particular needs in view.

The teacher. In a study of special abilities, the teacher is one of the factors which must be taken into account. The interests of the teacher often are seen in the achievements of the pupils as a whole. However, a special interest of the teacher in some pupils or an aversion of a pupil toward a teacher makes up for differences in achievement with respect to some subjects more than others. In case of aversion on the part of a pupil toward a teacher, a subject in which the pupil is dependent upon the teacher to a lesser degree might be more readily acquired.

Classification of pupils and special abilities. As has already been noted, Burt found that the school subjects could be grouped fairly well into four groups in terms of closeness of correlation or, in other words, in terms of abilities necessary for their mastery.

DeVoss[1] found that the various school subjects when measured by the Stanford Achievement Test ranked in order of independence of the other subjects as given in Table XX.

TABLE XX. SHOWING THE MEAN PERCENTAGE OF MEASURABLE DISPARITY FOR EACH TEST WHEN IT IS COMPARED WITH ALL THE OTHER TESTS

	PERCENTAGE IN EXCESS OF CHANCE PERCENTAGE
Spelling	37%
Computation	36%
Reasoning	32%
Language and literature information	31%
Woodworking	30%
History and civics information	27.6%
Paragraph meaning	27.5%
Sentence meaning	27%
Science meaning	26%
Music and art information	25%
Language usage	22%
Mean	29%

It will be noticed that spelling is the most independent and language usage the least.

The fact that all subjects are not equally dependent on the same abilities raises an important practical problem with respect to the classification of pupils. If any one or two of the school subjects is used for the purpose of determining the classification of pupils, we may expect the pupils to show great unevenness in the other subjects. Probably a composite score made from a so-called measure of general intelligence and the scores of several school subjects properly selected would give the best basis for classification.

---

[1] DeVoss, J. C. *Op. cit.*, p. 321.

QUESTIONS AND EXERCISES

1. Study the scores given in Table VIII, page 61. List the children who appear to be good in all subjects; those who score low in all subjects. List some who are irregular, that is, who score low in some subjects and high in others.
2. In your visits to schools, inquire whether there are pupils who seem to be notably good or poor in one or two subjects. If such a condition exists, find the reason for it, if possible.
3. If you find a pupil unusually good in some subject, try to find the cause for this. Determine the nature of his special ability.
4. Describe cases of irregular educational development you have noticed in your experience with children or as a student. Can you give reasons for the cases you have described?
5. Distinguish between special ability as an innate factor and as habit (poor attitudes, etc.).
6. List illustrations of abstract, mechanical, and social abilities.
7. List home conditions which may be conducive to the development of a special disability in some school subject.
8. If possible, secure records of educational tests administered to a class of children and compare evenness and unevenness of ability.
9. Why is it important for a teacher to know which of her pupils are good or poor in all subjects and which are good or poor in only a few?

10. Why should surveys for special talents, as musical ability, be made in the schools? Is it likely that such talent may not be discovered and thus never have an opportunity for development?

SELECTED REFERENCES

1. Bronner, Augusta F. *The Psychology of Special Abilities and Disabilities.* Little, Brown and Company. 1923.
2. Brown, A. W. "The Unevenness of the Abilities of Dull and of Bright Children," Teachers College, Columbia University, *Contributions to Education,* No. 220. 1926.
3. Burt, Cyril. "The Distribution and Relation of Educational Abilities," *The London County Council.* P. S. King and Son, Limited. 1917.
4. DeVoss, J. C. In *Genetic Studies of Genius,* Vol. I, edited by L. M. Terman. Stanford University Press. 1925.
5. Gates, A. I. *The Psychology of Reading and Spelling with Special Reference to Disability.* Teachers College, Columbia University. 1922.
6. Hincks, Elizabeth M. *Disability in Reading and Its Relation to Personality.* Harvard University Press. 1926.
7. Hollingworth, Leta S. *Special Talents and Defects.* The Macmillan Company. 1923.
8. Spearman, C. *The Nature of Intelligence and the Principles of Cognition.* Macmillan & Company, Limited, London. 1923.
9. Thorndike, E. L. "Intelligence and Its Uses," *Harper's Magazine,* Vol. CXL, pp. 13–32. 1919.

CHAPTER IX

LEARNING AND MOTIVATION

A knowledge and a technique of how to motivate pupils in their school activities is of fundamental importance to the teacher. Back of every activity of the child must be the *why* of the activity, and an explanation of the *why* must answer the question: What were the motivating factors involved? Good teaching involves a number of psychological factors, among which may be mentioned: (1) a knowledge of the growth and development of the individual; (2) a knowledge of the way in which the subject matter should be arranged or how situations should be presented; (3) a knowledge of how pupils learn and a fuller conception of the laws of learning; and (4) a technique for determining whether the aims of education are being achieved.

Motivation as a factor in the learning process is involved in all of the factors enumerated in the preceding paragraph. The psychology of motivation seeks to explain why children react in certain ways. From this it attempts to find methods of presenting material which will give students a "drive," or impelling interest, in the work of the school and thereby facilitate achievement. Indeed, good teaching may be thought of as motivation which produces desirable pupil behavior. This, of course, must be based on the innate ability and the level of development of the pupil who is to be motivated.

Motives, or drives, may be classified in two groups for the purpose of study. The first group includes those that are at first more dominating; they are largely physiological. The second group is made up of the acquired interests of the individual. Motives are frequently classified as innate and acquired. In one sense of the word all drives are innate, in that they are conditioned by and depend on physiological processes within the body. It is a well-known fact that innate drives are dependent upon physiological processes taking place within the organs of the body; fear, anger, and the various other emotions are dependent upon certain glandular secretions and other internal changes. At the beginning of life certain situations readily call forth fear reactions. These are unlearned and may be considered as depending upon particular structures of the organism which are ready to function at birth or shortly after birth. During the course of one's life, situations vastly different from those met early in life become potent for the individual. For example, the modern civilized adult is much more afraid of a tiny germ which he cannot see with the naked eye but which may be in the water he drinks than he is of the things which were feared earlier in life. The fear of the tiny germ is an acquired drive. Acquired drives become the most powerful motivating factors in the individual's life. Consider the emotional warmth with which one reacts to such words as home, mother, and country.

The relationship between biological and social motives. The two phases of human nature, namely, the biological and the social, are found to exist in all types of human activity soon after birth. Some writers on educational psychology have so expanded the term instinct that it is used to cover all those drives or motives with which we are concerned in education. This very loose way of mixing up the innate structure with the modification and integration of the structures into larger units or patterns has led to much dissatisfaction with the term instinct. No sharp line of demarcation can be drawn between activities that are prompted by social motives and those that are prompted by biological motives. The two are found to blend in all types of human activity quite early in life. Consider the hunger drive. Here the child soon links up hunger with certain situations, certain individuals, and with different types of behavior. The adult, in the case of the hunger drive, is not prompted solely by hunger but also by the group concerned, by the general surroundings, and by other stimuli that have entered in through experience to condition the reactions.

During the earlier years of life the biological motives predominate, but by the time the child reaches the school age the social motives are beginning to play a very important rôle in the directing of his activities. Of course it is to be remembered that all social motives have as their bases certain physiological structures and that they have been conditioned with respect to certain objects or persons through experience. The motives used in the schoolroom are primarily of the social type, but even here we can see constantly a blending together of the biological and social motives. Education is concerned with the universal interests of society and the development of that degree of skill which will be of value in carrying out the activities for which society has become responsible through various mutual interrelations.

Overcoming difficulties or obstacles. Woodworth lays down a fundamental principle in the motivation of human activity in connection with the overcoming of difficulties. Activities that are too difficult for the pupils fail to motivate them. This is in a large measure responsible for the poor work that is often found among children who have fallen behind in their work, and too often it is at this point that a dislike for school work is developed. Also a rather undesirable attitude toward other children and the school in general is found to begin at this time. This attitude may not manifest itself until a later stage; but the bad habits and unfortunate attitudes developed might well be averted if pupils were kept properly classified in respect to their ability to do the particular work called for. Activities that are too easy become automatic and uninteresting to the child. Outside activities will be taken up which, unless properly guided, may lead to behavior that is out of harmony with those traits the school is trying to develop.

The activities in which there are problems that demand thinking and the perception of relations, but which are within his power of apprehension, motivate the activity of the child. The motivating factor here cannot be adequately explained on the basis of instincts like curiosity and manipulation. These are only collective names for certain impulses that have been conditioned and integrated into larger units through the experience of the child. The capacity to acquire certain patterns of behavior which enable one to understand figures like the square, the cube, or the parallelogram is of course native; but it is through the experience of the child that this curiosity, or desire to manipulate, has evolved concerning the figures — their shape, meaning, and the like. Curiosity concerning figures cannot be explained on the basis of an innate motivating factor. One has but to study the development of meanings and concepts to see how these develop through the experience of the individual and how the meanings are enriched and begin to grow. Information and these concepts once established lead to a curiosity concerning certain relationships that are found. Once aroused this curiosity is oftentimes the motivating factor that leads to a further enrichment of concepts. Various impulses must play a part in the development of an interest concerning objects or persons. These impulses are supplemented through experience and are collectively considered as "curiosity."

Motives growing out of individual standards. "Anything worth doing at all is worth doing well." Many people, as pointed out by Perrin and Klein,[1] hold to the view that interest in doing a job for its own sake is often the motive in work. Teachers frequently set up as goals for their pupils the surpassing of their former record, thinking that they are thereby employing higher motives than those used when rivalry between individuals is employed. It is a question, though, whether or not such motives as rivalry with oneself or "a standard of work" which one wishes to meet are often but an extension of motives based on rivalry between individuals. The writers have among their acquaintances a man who has built streets in a certain city for more than forty years. This man is known for the good quality of his work. He has a general attitude that any street worth building is worth building well. A recent conversation with the man revealed that the following ideas seem to motivate his work: "I never leave a job unfinished"; "No one will ever point to a poor piece of work and say 'Blank did this'." In the conversation it could be seen very readily that the old street builder looked with contempt upon those who did a poor quality of work. This man has built up an individual standard of work, but it has developed out of a comparison made between his work and that of many others, as was clearly brought out in the conversation. A high standard of expectation must be set for each pupil. This standard of efficiency may grow out of comparisons made with the work of others or standards set by the teacher.

---

[1] Perrin, F. A. C., and Klein, D. B. *Psychology*, p. 191. Henry Holt and Company. 1927.

Motivation as it depends upon the previous experience of the child. The teacher who understands the importance of motivation in learning and recognizes its importance in the development of the child will find need for all the skill that he or she may command. Before intelligent motivation can be given the teacher must thoroughly study the capacities, interests, and background of experiences of the children. Each class will present its own special problems. Not only is each class different from every other class with respect to interests, outlook, and other factors, but children within a given class often differ widely from each other. A glance at Table XXI — which shows the distribution of the pupils from two sections of a fifth grade based upon the occupation of the fathers — will suggest the wide differences in the probable background of experience and interests between the two sections. These groups come from separate sections of a certain city and probably this is somewhat an extreme case in selection according to the occupation of the fathers; however, it clearly illustrates that the teachers of these sections have different problems to face. Each must work toward the aims of the school, but the two have different starting points and must travel widely divergent routes. A study of the group of children and of the individuals to be taught is the teacher's first task in the motivation of school work. The make-up of the individuals composing the group will set the limits and determine the methods to be used. The ordinary method that has been followed in the past is to motivate the group in accordance with its general average. Individual differences both in native ability and in acquired interests have been almost wholly ignored. The same general principles, the same kind of work, and the same kind of treatment have been accorded to all. All pupils have been thrown into the same kind of mold and an attempt has been made to make the individuals of the entire group fit the mold, regardless of the many differences that exist.

TABLE XXI. SHOWING THE DISTRIBUTION OF THE PUPILS FROM TWO SECTIONS OF A FIFTH GRADE BASED UPON THE OCCUPATION OF THE FATHERS

	SECTION 1	SECTION 2
Merchant	3	1
Physician	4	
Teacher	2	1
Minister	2	2
Banker	3	
Librarian	1	
Worker in tobacco factory		9
Policeman		2
Mechanic	1	4
Auto Salesman	1	
Clerk	7	2
Worker in hosiery mill		6

Organization and presentation of the subject matter. A factor in motivation that has been recognized as of primary importance for many years but which has received an added impetus through the McMurrys and, in still later years, through the *gestalt* concept in psychology is connected with the organization and presentation of the subject matter. This emphasis on the organization of the material is clearly seen in the type studies and projects of the McMurrys. The central theme in their work is that material must be presented in a related manner, for only through our past experiences are we able to interpret new experiences. If material is presented as in a real life situation rather than in isolated parts, and if the child is able to comprehend and appreciate the new experience because it is closely related to habits and ideas already established, a situation is created which calls for "a purpose of adjusting the new to the old, and the extent to which a close adjustment is secured determines the effectiveness of the instruction imparted."

According to the *gestalt* psychologists, learning can best be explained on the basis of configurations and pattern characteristics of a given experience. A *gestalt* is more than the sum total of its parts. According to this conception, the perception of a square is more than a combination of straight lines. Here we have a general pattern and, through experience, the organism comes to react to this configuration in a certain manner. The lines, supplemented by experience, become a unitary affair. In order for an individual to understand or be able to solve a problem, the total problem situation must be presented and reacted to as a unit. A new experience apart from the total problem situation is meaningless. Therefore, the presentation of the total problem in a manner that is related to the experience of the child is fundamental as a motivating factor in learning. In order to make learning effective it is of the utmost importance that the child be in the proper state of mind or in readiness for the general problem situation.

Woodworth refers to this readiness for the general problem situation as the *mental set* of the organism. In this the subject assumes an attentive attitude in response to the problem which furnishes the stimulation. There is a definite reaction readiness assumed. Certain stimuli are reacted to while others are not. This mental set acts as a selective factor in determining the subject's reactions. A good example of this is found in certain types of activities, as when a subject is given problems in arithmetic which require addition with a few subtraction problems scattered among them. He may not notice that these are to be subtracted and he adds them. In this case, the subject is in a "set" for addition and reacts to the problems involving subtraction in terms of addition. The proper attitude of readiness on the part of the subject is a fundamental factor in the establishment of the proper motivating situation in learning. The establishment of this readiness depends in a large measure on the skill of the teacher in the presentation of the subject matter. Here the teacher needs a philosophy of the place of the curriculum in the growth of children and skill in adapting it according to the individual interests, capacities, and needs of the child. It must always be remembered that there is nothing inherent in the materials of instruction which makes for growth unless they are properly organized and presented. This phase of motivation will be considered further and in a more practical way with the study of the different school subjects.

Interest and motivation. Education might sometimes succeed, and oftentimes does to an extent, in developing the opposite kind of habits from those which are desired by the school. Education consists in developing feeling attitudes as well as habits of skill and knowledge. The problem of interest is here closely related to, and of vital importance in connection with, the work of the school. An individual will never succeed if the ability necessary for doing the work of the school is lacking. On the other hand, an individual who has the ability but lacks interest will rarely succeed, and even when he does, it will not be to the full measure of his ability. Ability combined with interest will lead to a very high degree of success. Interest in a subject is closely related to achievement in that subject. Interest does not create ability; neither does ability create interest. Such factors as those that follow are of the utmost importance in respect to the development of interest by the child: (1) personality of the teacher; (2) the attitude of the teacher toward the subject; (3) home and other environmental influences; (4) the particular phase of the subject;

(5) organization and presentation of the materials; and (6) degree of intelligence.

Children's interests are often found to be transient; especially is this true where departmental work is carried on or when the teacher is a different one from year to year. The factor of the teacher enters into the problem of motivation and is to a rather large extent responsible for this transiency of interests. It should be further stated that superior incentives or factors are those which will develop enduring interests and are not used merely as devices for the present.

Praise and reproof in motivation. Much discussion has been devoted to the topic of "the comparative value of praise and reproof as motivating factors in learning." Elizabeth B. Hurlock[1] attempted to evaluate reproof, when used continuously over a given period of time, as contrasted with praise used in a similar manner. She had as subjects 106 children from the fourth and sixth grades of the Cameron Public School Building of Harrisburg, Pennsylvania. Four equivalent groups were formed: the control, praised, reproved, and ignored groups. These groups were equal in respect to initial ability in the performance for which they were being tested, and also in average age and number of boys and girls in each of the groups. The Courtis Research Tests in Arithmetic were given to the groups. "The control group, after the first test, was separated from the others, and was given the tests on the four remaining days in a separate room. No comment was made to them. They were merely asked to add the examples on the paper given to them at the beginning of the period. The other three groups took these tests together, but under different conditions of incentive." The tests used to measure the rate of improvement under the different conditions of practice were modifications of the Courtis Research Tests in Arithmetic. Table XXII gives the average scores for the two grades separately.

---

[1] Hurlock, Elizabeth B. "An Evaluation of Certain Incentives Used in School Work," *Journal of Educational Psychology*, Vol. XVI, pp. 145–159. Warwick & York, Inc. 1924.

TABLE XXII. AVERAGE SCORES. GRADE COMPARISONS [1]

GROUPS	AVERAGES				
	First Day	Second Day	Third Day	Fourth Day	Fifth Day
Control					
Grade VI	15.08	16.08	15.66	13.58	13.91
Grade IV	9.00	9.14	8.21	7.86	9.14
Praised					
Grade VI	15.25	19.33	22.42	23.50	25.16
Grade IV	9.06	14.40	16.00	15.06	16.26
Reproved					
Grade VI	15.33	20.33	18.33	17.58	17.83
Grade IV	9.06	13.60	11.06	9.80	11.26
Ignored					
Grade VI	15.16	17.99	18.16	17.58	16.58
Grade IV	9.00	10.93	9.14	8.93	8.79

---

[1] Hurlock, Elizabeth B. *Op. cit.*, p. 153.

From the results in Table XXII it is quite clear that in this experiment praise was the superior incentive. Praise and reproof were each effective as an incentive. A further analysis of the results from this experiment reveals some valuable as well as interesting information. Within the groups, it was found that reproof was more effective for boys than for girls; also that "inferior" children were more responsive to praise, while the "superior" children were more responsive to reproof. "Increased accuracy in performance was found only in the work of the children who were praised or reproved." The results from this experiment point conclusively to the fact that, regardless of such factors as grade, sex, or initial ability, praise is the most effective of the incentives used. "Reproof, when first used, seemed to be about equal in value to praise, but with continued use its effectiveness showed a decided decline. To ignore children in a group where the other members are receiving some incentive is psychologically bad."

These results are in harmony with those from other experiments which have been made on motivation. Gilchrist[1] reports a study in which fifty members of a class in educational psychology at George Peabody College for Teachers constituted the subjects. The Courtis English Test 4 B was given to the entire group. The class was then divided into two groups, placed in separate rooms, and the same test given again to the two groups. One group prior to taking the second test was reproved as follows: "A hasty examination of the papers in the test just given shows that the members of this group *did not do so well in the test as the average twelve-year old child would do.* I ask you to take the test again." The other group was praised as follows: "A hasty examination of the papers in the test just given shows that the members of this group did *exceptionally well.* I ask you to take the test again." Results from the two groups show:

---

[1] Gilchrist, E. P. "The Extent to Which Praise and Reproof Affect a Pupil's Work," *School and Society*, pp. 872–874. 1916.

1. The group that was praised improved the group score by seventy-nine per cent in the second test.
2. The group that was reproved made a lower group score in the second test than it had made in the first test.
3. In the second group those who had done well in the first test did not do so well in the second test, whereas those who had not done so well in the first test improved their scores in the second test.

These results are also in harmony with the findings of Kirby,[1] based upon an investigation in which he used 1350 pupils from the third and sixth grades of New York schools to determine the value of encouragement upon their performance in addition. Chapman and Feder [2] in 1917 reported an experiment in which a study of the relative value of certain incentives was made. The conclusions here are, in the main, in harmony with the other findings. In order to motivate pupils for achievement either praise or reproof is often expressed by the teacher in the form of gestures or facial expressions and the behavior of the pupils determined in part thereby. These expressions act as stimuli and are factors which thus modify pupil behavior. A nod of the head, a smile, a movement of the hand, or other forms of expression are often factors which motivate the pupils to further activity. Reproof in the form of display of temper is not for the best interest of the school, even though it might be a motivating factor in respect to the achievement. The negative influence that results will outweigh the immediate value that this might have as a motivating factor.

---

[1] Kirby, T. J. "Practice in the Case of School Children," Teachers College, Columbia University, *Contributions to Education,* No. 58. 1913.

[2] Chapman, J. C., and Feder, R. B. "The Effect of External Incentives on Improvement," *Journal of Educational Psychology,* pp. 269–274. 1917.

Knowledge of progress. Knowledge of progress has been found a very valuable motivating factor. Ross[1] conducted experiments on learning a simple act of muscular skill, namely, making groups of four vertical lines and crossing them with a fifth, after the order of the procedure used in tabulating and ordinarily referred to as "tallying." He used as subjects fifty-nine college students. These he divided into three groups. One of the groups was given full information concerning their progress from day to day, the second was given only partial knowledge of results, while the third had no information whatsoever as to their progress. The only factor which seems to have been variable was that of knowledge of one's individual progress. Results from this experiment show that progress is directly affected in a positive way by the knowledge that one has of the score made. This was found to be true both for speed and accuracy. It is of interest to compare the general conclusions here with those reached earlier by Book.[1] His experiment consisted in making legible *a's*. He found that the group working with full information concerning their progress lost the advantage gained by this form of motivation as soon as the information was withheld. Ross reversed the process on the eleventh and twelfth days, giving full information to those who had had none and no information to those who had received full information. In the experiments conducted by Ross, the results and general trend of the learning curves are not disturbed by this change, a fact which shows that the motivation gained during the first ten trials carried over during the next two trials. The educational implication from this is of profound importance for the teacher. A close and accurate check, with full information as to the progress being made at the different stages of the learning and the errors made, is not only a motivating factor which is of utmost importance to the pupils concerned, but it also furnishes invaluable information to the teacher which will aid in a diagnosis of the student's achievement. Such a check also suggests the processes on which more emphasis should be placed and further treatment given.

---

[1] Ross, C. C. "An Experiment in Motivation," *Journal of Educational Psychology*, pp. 337–346. May, 1927.

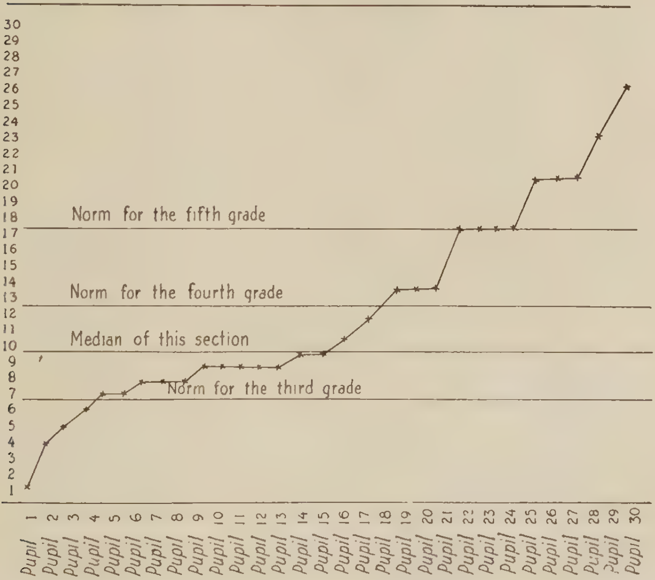
---

[1] Book, W. F., and Norvell, Lee. "The Will to Learn," *Pedagogical Seminary*, pp. 350–361. December, 1922.

Standard tests and motivation. Standard tests are of great value in motivating school work because they furnish a definite knowledge of the results and relative standing in achievement for the pupils. Through standard tests a pupil is able to tell whether he is above or below the average for his grade; also, where he stands in relation to the other members of the class. Standard tests usually introduce a spirit of competition or rivalry which is wholesome. This feeling or spirit introduced might extend to other groups or be limited to the members of the particular class. A good method of showing the distribution of scores made on a test is shown in Figure 7. This shows the distribution of the comprehension scores made by a fourth-grade class on the Monroe Silent Reading Test. The norms for several grades are given. These represent the average scores obtained from giving the test to a large number of unselected children in the several grades. The median for this section of the fourth grade is shown on the graph. Pupils are given their scores and thereby know where they stand on the test. Their names might be placed on the graph in the space where Pupil 1, Pupil 2, etc., are placed. The pupils are thus motivated individually to better their position with respect to the other members of the class. As a group, they may thus be motivated further to increase the average of the class.

Standard tests may be used also for purposes of motivation when definite testing programs are carried out by having the pupils keep their individual records and make comparison of their progress at the different stages of their learning. Sometimes practice sheets of various kinds may very well be used in this manner. Here again the pupils are motivated to compete with their own record. Norms as already discussed may be given them and by means of tests they may see how near they are to meeting the standards set for the grade. This type of motivation can

FIGURE 7. SHOWING THE DISTRIBUTION OF SCORES MADE BY A SECTION OF THE FOURTH GRADE ON THE MONROE SILENT READING TEST (COMPREHENSION SCORES)



be used successfully by the skilled teacher in connection with any of the school subjects.

Another means of using standard tests as a motivating factor is to show the distribution of scores made on the particular test. This method is illustrated in Table XI, page 66. Here the distribution of the scores made, together with the norms for each grade as well as the median score made by the particular grades, is shown. In this case, each grade is motivated not only to bring its median up to the norm or even above the norm, but also to do better than the other grades as measured by their norms. This type of motivation can be used in all the elementary grades. There is one danger, however, which should not be overlooked. The "superior" pupil must not be satisfied with a score that is just equal to the norm for that grade. This danger is likely to enter if the teacher does not see that such a student is motivated to work for a high level of achievement.

The class as a motivating factor. One of the primary advantages to be derived from class instruction is the influence that group instruction has on the individual members of the group. Working in the presence of other pupils, even though there is no contact or communication, establishes certain attitudes that are of value to the pupils in motivation. Individual differences are noted in respect to susceptibility to the influence of the group. Most investigations show that children are more susceptible to the facilitating social influences than adults.

Furthermore, the slower and poorer workers usually derive greater profit from the group influence than the more rapid and efficient.

Here, with this group influence, comes rivalry again. The drive to excel others is often found to be an effective stimulus in the hands of one who knows how to work with a group. Rivalry may take many different forms and its effect will vary for different individuals. There are certain dangers which must be considered, however. The effect of rivalry may actually be negative, or it may be positive for the immediate time but negative for activity more remote in time. Rivalry and social facilitation are much used in the classroom. Here a group of pupils are at work on the same tasks. Their responses are facilitated by the contributory stimulations from the activity of the other pupils as well as from the general setting of the school.

It has been found that the influence of the group is more beneficial for sensori-motor activities than for intellectual. This fact should be considered in the assignment of home work. Problem work is usually done better individually. Such subjects as writing, reading, and spelling function more satisfactorily when carried on in group work. Socialized recitations have their advantage in that problems are here brought forth and given life. The pupils are confronted with problematic situations which they try to settle when alone.

School morale and motivation. School morale can be used as a motivating factor not only for the promotion of greater achievement in the school subjects but also for the building up of honest, worthy habits that will be for the best interest of society. The value that a good school morale has cannot be denied; neither can it be overemphasized. The question that most concerns the teacher here is: How can a good school morale that will serve the purpose of building up the best habits in the individuals concerned be achieved? Good school morale cannot be built up in a single day but there are certain of its essential features for which the teacher is in the main responsible.

Personality of the teacher. First among those factors which make for the proper attitudes toward the school and its work is the personality of the teacher. Do the pupils have confidence in her character and ability? Can they depend upon her for fair treatment and sympathetic coöperation at all times? Does her personality give life and force to the schoolroom? A teacher whose honesty and fair treatment are questioned by the children is greatly handicapped in her work. A teacher who does not take a sympathetic attitude toward the problems that confront her pupils cannot arrive at the fullest success in his or her work. These factors are in a large measure responsible for the general conduct of the students. The activities of the pupils and the habits established are directly related to those of the teacher.

Community spirit. Another factor of primary importance is the proper community spirit. Here we have as a factor the attitude of the parents. The question concerning the development of good morale is: Have the aims, ideals, and need for education been understood and accepted by the people of the community? It often takes a long time for the school patrons to arrive at a full conception of the true aims of education and the relation that exists between the school and its patrons. Often wise leadership is of great value in the acquisition of this larger concept. The general administration of the school and the organizations in which both teachers and parents are concerned are factors that may function beneficially in the development of coöperation and understanding between the school and its patrons.

Establishment of ideals. Good school morale will depend to a large extent upon ideals established in the group. These ideals are enhanced by the two above-named factors; but in addition to the patrons and the school there should be certain traditions, attitudes, and habits built up that will function for the development of such ideals as are in harmony with the making of good, worthy, and useful citizens. In the establishment of these, extra-curricular activities can be made to function in a profitable manner. This aim, the establishment of ideals, should dominate in such activities as the various clubs, athletics, and student participation in the government of the school. In these activities the student is given a chance to bring into play the actual ideals that are in harmony with the best interest of society. Loyalty to the school can be developed here. Especially is loyalty found to be strong when competition becomes keen in activities in which the student body is highly interested. Oftentimes this loyalty will manifest itself through some form of emotional attachment, *e.g.*, to the school's yell, to the school's song, or to the school's colors. Of course keen competition is not essential for loyalty. Students may come to love honesty because of certain traditions set up in the school in which honesty is ever encouraged and looked on with favor while dishonesty is looked on with shame. In the establishment of traditions the personality of the teacher may be the primary factor. Such traditions once established can be made a motivating factor which is of value in promoting the best interests of the school. These ideals and traditions will cause the pupils to feel themselves a part of a group whose character and behavior demand the highest respect.

Fundamental principles in motivation. In a final analysis of any stimulus that might be used as a motivating factor, certain fundamental principles must be considered. First among these principles is: Does the positive influence outweigh any negative influence that might ensue? Scientific investigations in this field have not been carried out to any large extent. Furthermore, scientific investigations give the immediate results obtained rather than results which might appear later. In any consideration of motives a teacher must use her knowledge of the psychological principles involved. Another factor that must not be overlooked is: How permanent is the motivation? If motivating factors can be used that will either directly or indirectly have a permanent positive value, such factors may be temporary or permanent according to the manner in which they are employed. If they are to have a permanent influence, they must be given an opportunity to operate successfully and there must be no exception to the results of the motivation used.

QUESTIONS AND EXERCISES

1. What is meant by the term motivation? Give examples of worth-while pupil activities which are carried on even when the school makes no effort to foster these. Where does the motivation come from?

2. Does the personality of the teacher have anything to do with the development of interests? In departmental work in the upper grades, have you found the pupils more interested in one subject than in others? Did the personality of the teacher have any relation to the unusual interest?

3. What is meant by transient interests? Permanent interests? Are most interests transient ones? Can you illustrate how a teacher should try to develop a transient interest which is desirable so that it will become a permanent one?

4. What was Hurlock's conclusion concerning the comparative value of praise and reproof as motivating factors? How do boys and girls compare in her experiment? Compare the inferior and superior groups.

5. Discuss the factor of knowledge of results as an influence in motivation. Give the conclusions of Ross. Do you think it wise to let superior students know the

results of intelligence and achievement tests? Would you tell a bright child his score? Would you tell a dull child his? Do you think it wise to graph the scores made by the members of a class, as shown in Figure 7, and to post the graph where all the pupils may see it?

6. For what type of work does group activity seem to have the greatest value? Can you explain why this is so? How should a teacher of a fifth grade take this fact into account?

7. For what type of student does group activity seem to be of most value? Can you see any reason for this? Ask a teacher in the elementary school what her experience is concerning the point discussed here.

8. How is motivation closely linked with the subject of individual differences? In your observation of children, do you find any who are about the same age and who score about the same on an intelligence test but who differ considerably in achievement as measured by standardized tests?

9. Administer a standardized test to a group of children and graph the results. Show the median for the group. If you do not have the opportunity to administer a test, use the results of a test as presented in Table VIII, page 61.

10. Visit a class in the elementary school. Notice carefully how the teacher uses the interests of the children in motivating the work of the recitation. Make notes of any definite efforts to motivate the work and be prepared to discuss these in class. What suggestions have you to offer regarding additional means of motivation which the teacher might use?

SELECTED REFERENCES

1. Allport, F. P. *Social Psychology*, pp. 260–302. Houghton Mifflin Company. 1924.
2. Cash, L. E. "Motivation in the Small High School through Interclass Efficiency Contests," *The School Review*, Vol. XXXV, pp. 121–124. February, 1927.
3. Chapman, J. C., and Feder, R. B. "The Effect of External Incentives on Improvement," *Journal of Educational Psychology*, Vol. IX, pp. 269–274. 1917.
4. Gilchrist, E. P. "The Extent to Which Praise and Reproof Affect a Pupil's Work," *School and Society*, pp. 872–874. 1916.
5. Hurlock, Elizabeth B. "The Value of Praise and Reproof as Incentives for Children," *Archives of Psychology*, Vol. XI, No. 71. 1924.
6. Hurlock, Elizabeth B. "An Evaluation of Certain Incentives Used in School Work," *Journal of Educational Psychology*, Vol. XVI, pp. 145–159. 1924.
7. Kirby, T. J. "Practice in the Case of School Children," Teachers College, Columbia University, *Contributions to Education*, No. 58. 1913.
8. Knight, F. B., and Remmers, H. H. "Fluctuation in Mental Production When Motivation Is the Main Variable," *Journal of Applied Psychology*, Vol. VII, pp. 209–223. 1923.
9. Laird, D. A. "How Some High School Students Respond to Different Incentives," *Pedagogical Seminary*, Vol. XXX, pp. 358–365. 1923.
10. Mayo, M. J. "The Standard Test as a Means of Motivation," *The Texas Outlook*, pp. 8–9. May, 1927.

11. McMurry, C. A., and McMurry, F. M. *The Method of the Recitation.* The Macmillan Company. 1911.
12. Perrin, F. A. C., and Klein, D. B. *Psychology, Its Methods and Principles.* Henry Holt and Company. 1926.
13. Ross, C. C. "An Experiment in Motivation," *Journal of Educational Psychology*, Vol. XIX, pp. 337–346. May, 1927.
14. Sullivan, Ellen B. "Attitude in Relation to Learning," *Psychological Review Monographs*, Vol. XXXVI, No. 169. 1927.
15. Wilson, H. B., and Wilson, G. M. *Motivation in School Work.* Houghton Mifflin Company. 1921.
16. Woodworth, R. S. *Dynamic Psychology.* The Macmillan Company. 1918.
17. Woodworth, R. S. *Psychology: A Study of Mental Life.* Henry Holt and Company. 1921.

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE

CHAPTER X

THE PSYCHOLOGY OF THE TEACHER

The purpose of this chapter is to stress the importance of the teacher in the development of children. The most important single factor in the total school situation is undoubtedly the teacher; yet, in speaking of a school, we usually refer primarily to buildings and materials used for school purposes. The teaching organization which functions in the building receives less consideration in the mind of the average patron. The teacher as a factor in the total school situation has received much less emphasis than his importance in the education of children deserves. Many communities make great efforts to build and equip magnificent buildings. Great care is exercised in the planning and building. Seldom is equal care shown in the selection of teachers. Usually sufficient money is not available to pay salaries which will attract talent commensurate with the material resources of the school. The main reason for this condition lies in the fact that the school building is something objective which can be pointed out and in which the community can take a pride while good teaching is less objective. It is harder to objectify the results of teaching; consequently these are not things to which the community can so definitely point.

The whole community is interested in the building because it belongs to all. The humblest citizen can point with pride to *our* school, referring generally to the buildings, equipment, and grounds. It is a little more difficult to build up a community spirit to such a degree that the members of the group are proud of the children of the community and wish for each the highest development. The psychology of the situation is such that individual rivalries and jealousies between members of the group make it almost impossible for a community to promote to the highest degree the development of the children of the community.

No one probably would deny the statement that the conservation of its children is the first and highest duty of any society. The statement that the teacher is the most important factor in the school situation would likewise meet approval, yet society has given little care to the selection of its teachers and, until recently, little more to their training.

What is the function of the teacher? The function of the teacher in society may be considered from a number of points of view. Teaching is a very old profession. Like all other social institutions, the school has changed as man attained higher degrees of civilization. In the early history of the human race, life, as we view it today, must have been very simple. Most of man's skills and information were concerned with the simple affairs of everyday life, such as hunting and fishing. During this period the child learned directly from the parent the necessary useful information. Such learning, however, must have been largely incidental. As time went on, life became more complicated. Discoveries were made; agriculture and even trade developed. With these, there naturally arose many social institutions. Life became more and more complex because with each new discovery and with each step in the development of social institutions man's social environment became more dominant and his natural one less so. The older members of the family probably continued to instruct the younger until life became too specialized. When it became apparent that the members of the group who had received superior training were most successful, the time was ripe for the school as a social institution.

At first the chief aim of instruction was probably concerned with such skills and information as would prepare the child for a place in the economic life of the group. This aim has been and seems to be the dominant one today. However, the teacher's function is a much broader one than merely preparing the child for participation in the economic affairs of society. His chief concern is in the orderly development of the child in every phase of life. His first question regarding any materials for instruction is: What do they contribute to the growth of the child? The teacher's chief function, then, is to handle the materials of instruction so as to provide for the best development of the individual child. The same thought may be stated in this way: It is the teacher's duty to arrange and present such parts of our social heritage to each child in the light of the child's ability and state of development so as to further his growth. This is a difficult task indeed, and, in order to be successful, the teacher must possess certain fundamental characteristics.

The teacher's personality. What is meant by the term "personality"? Personality is a very complex thing and is almost incapable of definition. There is no general agreement as to what personality is. Various authorities use the term in different ways. From one point of view, personality is largely a result of heredity, that is, the result of the inheritance of certain temperamental, mental, and physical traits which manifest themselves in a given environment. From another point of view personality is a result largely of environmental influences which develop certain characteristic behavior traits in the individual. From still another point of view personality consists of all the habits, attitudes, and ideals possessed by an individual as a result of his particular heredity and as a result of the reactions which he has made to environmental stimuli. These are not totally different viewpoints; however, each places the emphasis on slightly different things. One's total personality may be regarded as all the behavior patterns which he has developed during his life.

Personality cannot be thought of apart from some situation which involves others, for, by the very nature of the case, when we speak of an individual's personality we imply that he impresses or influences us in certain ways. An individual, then, may have a good personality in one situation and a poor one in another. When the question is raised: "Has the teacher a good personality?" another question: "Good for what?" should also be raised. Too frequently the personality of the teacher is judged by the way he impresses members of the school board or an administrative officer and not in terms of a schoolroom situation. An individual may possess a personality which will lead to success in the upper grades but to failure in the lower grades or vice versa. The writers know a teacher who lost his position because the school authorities thought he did not have a good personality. Yet, judged by results in terms of what he accomplished with his pupils, he had a superior personality. The test of personality is influence and action in some particular situation.

Most teachers, if they will take the trouble to examine themselves, know in what situations they function successfully. They also know, generally, why they fail in others. The teacher who accepts a position unsuited to his personality does himself an injustice. Likewise, the teacher who continues to hold a position to which he cannot adjust his personal traits to meet its demands does himself an injustice. Fortunately most teachers can, if they will but analyze the situation and find the weak points in their personality, so modify themselves as to be successful.

As stated at the beginning of this topic, personality is a very complex thing. Many elements enter into this complex but it must always be remembered that they function as a unit as each person influences the behavior of others. In studying one's own personality, the point to be kept in mind always is that personality has reference to social situations. One should ask himself, "How do my behavior traits influence others?" In some school situations one of the elements entering into personality may be largely dominant; in another situation some other element may be the one most powerful in influencing the behavior of children. The habits and attitudes entering into personality are almost too numerous to mention. Some of those which influence the behavior of children are: (1) sympathy, (2) a sense of fair play, (3) open-mindedness, (4) tact, (5) honesty, (6) stamina, (7) accuracy, (8) loyalty, (9) truthfulness, (10) ability to see the other fellow's point of view, (11) regard for the rights of others, (12) a sense of humor, (13) sincerity, and (14) an interest in children and their problems.

Characteristics of successful teachers. In a survey of the literature on the subject, the characteristics listed below were found mentioned most often:

1. Good personality
2. Scholarship
3. Professional preparation
4. Knowledge of children
5. Resourcefulness
6. Character
7. Qualities of leadership
8. Industry
9. A philosophy of education

It must be understood that no teacher possesses all of these to the same degree. Each is possessed by every teacher to some degree at least. An individual possessing all in a high degree would be considered an exceptionally fine teacher or one with rare teaching ability. These traits may be found in teachers in various combinations. A teacher may be strong in certain points and weak in others while another teacher may be about average in all.

The development of personality. When we consider that the total personality of an individual has reference to all the habits of action, feeling, and thought which he has developed, we realize that personality is largely a result of learning. Personality should be considered always in terms of a social situation. If we attempted to measure personality, we would be compelled to consider how other individuals are influenced by that personality. The measure of a teacher's personality should be considered in terms of how children respond to him.

Since personality is to such a great degree a result of learning, there is no reason why persons with weak personalities cannot develop stronger ones. Neither is there any reason why personality defects cannot be remedied. Certainly no one can go beyond the limits which nature has set for him and it must be recognized that certain physical characteristics, as size and stigmata, do set limits. However, most weak personalities are the result of the formation of undesirable habits and attitudes.

In a study of the elements of a good teaching personality, Clapp[1] found evidence that personality is changed in a positive manner by experience and training. In commenting on this study Bagley[1] says:

---

[1] Clapp, F. L. Unpublished Master's Thesis, University of Illinois. (Quoted by Bagley, W. C. *School Discipline.*)

> The important result of this study is the evidence that it offers against the fatalistic notion that the important factors in the teacher's personality are not improvable through the discipline of experience and training. There are undoubtedly some individuals who could never improve their manner of meeting people (their "address"), and there are others, perhaps, who could never make their "personal appearance" more attractive. Still others, it is clear, are natural pessimists, and neither experience nor training nor inspiration could transform their gloom and depression into "optimism" and "enthusiasm." Still others are naturally undignified and can have no commanding influence over their fellows. They lack "reserve" and can never create it. Some, too, are naturally unfair, or weak in vitality, or deficient in sympathy. But, after all acknowledgment has been made to the fatalists, it must still be admitted that most individuals *can* change and improve these various qualities. Knowing what factors "count" in a teaching personality, the beginning teacher, under wise supervision, may adopt measures that will work what might seem at the outset to be little less than a miracle of transformation.

There are a number of things fundamental to the development of a desirable personality. The first is an intense desire to improve together with habits of work which will cause one to stay at a task until it is finished. The second thing necessary to the development of a good personality is an analysis of the situation in order to decide what kind of personality is needed. A good personality is one which, in a certain situation, influences others in a desirable way. A third thing fundamental to the development of a personality is a thorough self-analysis with reference to the type of personality desired. Sufficient energy and drive to make the effort is the fourth prerequisite to the development necessary for a change in personality.

---

[1] Bagley, W. C. *School Discipline*, p. 33. By permission of The Macmillan Company, publishers. 1915.

Teachers' Rating Scale

	Strongest	Good Average	Average	Poor Average	Weakest
Sympathy					
A sense of fair play .					
Open-mindedness . .					
Loyalty					
Responsibility . . .					
Persistence					
Speech					
Tact					
Honesty					
Stamina					
Accuracy					
Truthfulness					
Humor					
Personal appearance .					
Consideration for the opinions of others .					
Interest in children .					
Initiative					

The use of a rating scale, such as that given above, is of value in helping one determine his standing in various personality traits and in showing him where his efforts at improvement should be made. All of the personality elements listed in the scale are at least partly a result of learning and are therefore susceptible to improvement.

The teacher's preparation. There are at least three factors that enter into the preparation of the teacher in addition to personality, which has already been considered. These factors are scholarship, professional training, and a knowledge of children. They might all be considered under the topic, professional training. However, for purposes of study it is probably better not to do so.

Scholarship like personality always has reference to some environment. A man specially trained in higher mathematics would find his scholarship of little use in teaching in the grades. The elementary teacher should possess broad scholarship which will function in her work with children. The distinction which is often made in salary between teachers in the lower and higher grades cannot be justified in terms of scholarship. The teacher in the lower grades needs just as rich background in scholarship as the teacher in the higher grades. The difference is not in point of scholarship but in the type of materials dealt with.

There are many successful teachers who have had little professional training. However, their teaching ability may be explained on the basis of good native ability plus such experiences as aid one in teaching situations. These teachers, even though they are successful, would probably be much better if they had taken systematic professional training.

Teaching is becoming a highly technical profession. So great a body of useful knowledge concerning the various aspects of teaching is now available that no teacher can hope to compete with others unless he has had professional training. No one knows the exact relationship between professional training and success in teaching. There are some individuals who because of defects of one kind or another would never be successful as teachers regardless of the amount of their training. Whitney[1] studied the use of a number of factors in the prediction of teaching success. In the study, data from 1156 normal school graduates were used. He makes the following statement regarding certain factors contributing to teaching success.

> The final summation of the five rankings resulted as follows:
>
> 1. Student teaching
> 2. Professional marks
> 3. Physique
> 4. Academic marks
> 5. Secondary record
>
> The implication is that, for purpose of curriculum making, this ranking suggests degrees of emphasis which may be desirable if the ultimate criterion, teaching success after graduation, is held in mind.

---

[1] Whitney, F. L. "The Prediction of Teaching Success," *Journal of Educational Research Monographs*, No. 6., p. 65. 1924. The Public School Publishing Company, Bloomington, Ill.

The professional training of teachers consists largely of training which leads to an understanding of children. The teacher is no longer considered successful who merely has a knowledge of the materials of instruction. With a fuller understanding of the psychology of the child, there has come a demand that materials be used in accordance with his developmental needs. The teacher must be able to analyze the pupil's present level of development and plan for further development in terms of the child's present condition. There is no operation in any profession which demands more insight and skill than that required of a teacher who attempts to adapt materials of instruction to the needs of her pupils. Great technical ability is required in the analysis of difficulties which are the result of poor training and in the construction of methods for overcoming these difficulties.

Some of the knowledges and skills which a teacher should possess are listed below:

1. A knowledge of how children develop; the relation of subject matter to development; individual differences in rate of development.
2. A clear knowledge of the interests and points of view of children at each age and how to adapt the subject matter in the light of these.
3. A knowledge of the principles of learning and of how to arrange subject matter for economical learning.
4. A knowledge of the function of the school and of its place in society. This also involves a knowledge of the school as a factor in the history of civilization.

5. A knowledge of the part that past experience plays in the present activities of the child.

6. A knowledge of the aims of education in general and of its aims in each subject in particular. This also involves a knowledge of how each subject functions in the development of the child.

7. A knowledge of the technique needed in analyzing pupil difficulties and of how to build up interests and correct defects through the use of materials. This also involves a knowledge of how to organize and adapt subject matter to difficult cases.

8. A knowledge of the psychological factors involved in discipline. This involves a knowledge of the causes of behavior problems and how these causes should be treated.

Studies of the causes of failures. In a study by Buellesfield[1] data were gathered from 116 school systems employing a total of 4848 teachers. Of this number 135, or 2.77 per cent, failed in one year. It was found that the smaller school system had a much greater percentage of failures than the larger. Careful selection on the part of more competent selective agencies in the larger systems probably accounts for fewer failures in these systems. Very little sex difference was found with regard to failure. The tabulation on page 200 shows the principal causes of failure as reported in this study.

An examination of the data collected by Buellesfield reveals the fact that very few causes are listed which may not be considered as habits and attitudes or, in other words, as personality traits.

---

[1] Buellesfield, Henry. "Causes of Failures among Teachers," *The Elementary School Journal*, Vol. I, pp. 439–452. University of Chicago, Department of Education. September, 1915.

Causes of Failure	Chief Cause	Contributory Cause	Total
Weakness in discipline	114	54	168
Lack of judgment	54	86	140
Deficient in scholarship	42	40	82
Poor methods	41	79	120
Daily preparation insufficient	24	51	75
Lacked industry	19	28	47
Lacked sympathy	17	45	62
Too nervous	15	30	45
Deficient in social qualities	15	27	42
Unprofessional attitudes	14	28	42
Unattractive appearance	12	29	41
Poor health	12	13	25
Lack of culture and refinement	11	28	39
Uninterested in work of teaching	10	26	36
Too many outside interests	10	23	33
Immoral	10	1	11
Too frivolous	9	17	26
Disloyalty	9	16	25
Could not control temper	7	23	30
Deceitful	7	19	26
Untidy in dress	7	14	21
Remained too long	5	17	22
Too immature	3	13	16
Wrong religious views for that community	2	3	5
Attended questionable amusements	1	8	9
Keeping company with high school boys	1	0	1
Use of tobacco	0	1	1

Self-analysis. The writers believe that most teachers seldom, if ever, attempt to analyze their own development and plan for future growth. Individually, we would make greater progress, if we definitely recognized (1) what we are, (2) how we came to be what we are, and (3) what we should strive to be.

Every person is a result of hereditary and environmental factors. It must be remembered that the influence of these cannot be separated; however, it is valuable to raise a number of questions in connection with each. With respect to one's heredity the following queries are suggestive:

Are there any mental traits which seem to be possessed by most of your relatives? Which of these are desirable? Which are undesirable? With respect to energy, are your relatives as a rule above average? average? below average?

What were the characteristics of your environment as a child? Where did you live: in the country or in the city? How many children were there in the family? What were the occupations of your parents? What were the chief interests of your family? To what social and religious organizations do you belong?

What are your chief amusements? What are your chief reading interests? Do you make plans for the future and attempt to carry them out? Do you make friends easily? Do people confide in you? Do you accept responsibility?

An analysis of oneself should lead one to a knowledge of his traits, an understanding of how they were developed, and a basis for their future development and modification. In analyzing oneself, however,

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE

care must be exercised that an objective attitude is taken. There is always danger that a critical attitude regarding self may lead to self-consciousness. This must be carefully guarded against; however, the self-satisfied attitude is equally harmful. Individuals should frankly recognize the weak points and the strong points in their characters and constant effort should be made to strengthen the former and to make the best possible use of the latter.

The teacher and the teaching situation. The older notion of the teaching situation as one in which the teacher merely hears the recitation is no longer held by competent school people. This notion failed to take into account a number of important elements in the learning process. This wrong conception of the teacher as being merely the assigner and hearer of lessons has been replaced by one in which the teacher's function is to guide and direct children in their education. In this respect the teacher's duty consists largely in helping arrange materials so that children can more effectively react to them. Materials are to be arranged and presented in such a way as to stimulate children to activity of a desirable kind.

The statement above calls attention to another important principle, namely, that children grow only by their own activity. Any activity on the part of the teacher is useless, or probably worse than useless, if it does not stimulate pupils to activity. Learning takes place in an individual only through his own activity. The child is not developed by the school except as the school furnishes stimulation and opportunities for desirable activity. Learning is not a process of absorption but rather one of growth as a result of activity. In the real sense the teacher can make no lesson interesting. However, he may present materials which are so organized that the child will react in terms of previously developed interests. Here again the teacher's function in handling the materials of instruction must be considered in terms of the child.

Although learning is an individual matter and depends on self-activity, yet most learning in school occurs in social situations. The teaching situation is a social situation. Since this is true the total situation must be considered when we study the activity of the child. The pupil not only reacts to the materials of instruction but to the teacher and to his classmates as well. The interests and attitudes of the pupil are to a large degree dependent on the interests and attitudes of the other members of the social group. The teacher is usually the most important member of the group as far as causing pupil activity is concerned. The interests and attitudes of the teacher, then, will be most powerful in shaping those of the pupil.

An important item in learning relates to the idea that information gained is not just so many facts learned but rather so many facts learned in a definite situation. They are of value, dynamic, and worthy of retention only as they have been given such meaning by the situation in which they are learned. The importance of the teacher as a factor in the vitalization of the work of the school cannot be overemphasized.

QUESTIONS AND EXERCISES

1. List ten duties of a teacher in order of importance.

2. List ten habits which each individual must develop but for which the school is not responsible.

3. List the aims of education given in several of the references at the end of this chapter.

4. Find in the references several definitions of personality. How do these agree? In what way does the notion of personality given in this text differ from that found in each of the references consulted? Why is personality referred to as a very complex matter?

5. List the traits of two highly successful teachers and two unsuccessful ones. In what respects do they differ?

6. Rate yourself on the rating scale given in this chapter. On each trait let "strongest" be represented by a value of 5 and "weakest" by a value of 1. Check yourself on each trait and then find a total. Outline for yourself a program which will strengthen your weak traits.

7. Which traits listed on the scale help you most in dealing with children?

8. What is meant by the statement, "Scholarship like personality always has reference to some environment"?

9. Study the causes of failure found by Buellesfield and check those which you think account for the failure of teachers you have known.

10. Compare several teachers as to the extent to which they are dominating factors in the schoolroom. Do you find some teachers who seem to want to assume full domination over the situation? Do you find others who

remain in the background as much as possible and who seem merely to guide? If you find such situations, study the activity of children under the different conditions.

SELECTED REFERENCES

1. Almack, John C., and Lang, Albert R. *The Beginning Teacher*, Chap. I. Houghton Mifflin Company. 1928.
2. Bolton, Frederick. *Everyday Psychology for Teachers*, Chap. XVII. Charles Scribner's Sons. 1923.
3. Burnham, William H. *The Normal Mind*, Chap. XV. D. Appleton and Company. 1924.
4. Chapman, J. Crosby, and Counts, George S. *Principles of Education*, Part I. Houghton Mifflin Company. 1924.
5. Charters, W. W. *The Teaching of Ideals*, Chap. I. The Macmillan Company. 1927.
6. Frasier, George Willard, and Armentrout, Winfield D. *An Introduction to Education*, Chap. I. Scott, Foresman and Company. 1924.
7. Groves, Ernest R. *Personality and Social Adjustment*, Chap. XVII. Longmans, Green and Company. 1923.
8. Knight, F. B. "Qualities Related to Success in Teaching." Teachers College, Columbia University, *Contributions to Education*, No. 120. 1922.
9. Leighton, Joseph A. *The Individual and the Social Order*, Chap. XXII. D. Appleton and Company. 1926.
10. Monroe, Walter S. *Directing Learning in the High School*, Chap. III. Doubleday, Doran & Company, Inc. 1928.

11. Ogden, Robert Morris, *Psychology and Education*, Chap. I. Harcourt, Brace and Company. 1926.
12. Sears, J. B. *Classroom Organization and Control*, Part I. Houghton Mifflin Company. 1918.
13. Smith, Walter Robinson. *Constructive School Discipline*, Chaps. III and IV. American Book Company. 1924.
14. Symonds, Percival M. *The Nature of Conduct*, Chap. XV. The Macmillan Company. 1928.
15. Waples, Douglas. *Problems in Classroom Method*, Chap. I. The Macmillan Company. 1927.
16. Whitney, Frederick Lamson. "The Prediction of Teaching Success," *Journal of Educational Research Monographs*, No. 6. Public School Publishing Company. 1924.

CHAPTER XI

THE PSYCHOLOGY OF LANGUAGE

What is language? Language may be considered in the main as composed of sounds which an individual produces by means of his speech organs as responses to social situations. Furthermore, the concept of language demands that these sounds serve as stimuli which are capable of arousing in other members of the same language group certain definite responses. Language, however, is a broader concept than communication by words alone. Language is communication with others, and communication is not limited to speech alone. Various signs are used in making known our wants, feelings, and interpretations. Deaf mutes use a highly developed system of signs in communication. All persons develop little mannerisms which are understood by close associates. More general bodily movements which carry meaning are developed by larger language groups. Facial expressions which depict certain emotions, gestures which are recognized as carrying definite meanings, as well as general bodily posture — the bowed head and stooped shoulders — may be almost universally interpreted.

Biological basis of language. It is an important fact, now generally recognized, that the ability to acquire speech is innate but that the particular language one learns is acquired. The ability to acquire language must be thought of in terms of the neuro-muscular coördinations made possible by the biological nature of the individual. The organism in its development in response to stimuli is able to coördinate the movements of the various organs which function in speech and produce a unified response. Thus it is seen that speech depends upon the building of complex movements out of more simple ones so that definite sounds are produced by the speech organs and are produced when the individual desires to make them.

While it is undoubtedly true that the ability to acquire speech is innate, it is equally true that the language one acquires is wholly a result of environment. It is also true that the environment which determines the language an individual learns is not a result of what might be called a natural environment, that is, a racial, geographic, or other natural division, but of a social environment. The child learns all his words and language forms directly from others about him. A person reared in one part of the country acquires the speech habits peculiar to that section. It often happens that people with a common language but scattered over a wide area develop local expressions which may be explained in terms of local conditions. Persons moving early in life from one section of the country to another and being reared there tend to acquire the local peculiarities of the language in the new section just as if they had been born there. Not only is this true of people with a common biological heredity but also of people with a different biological heredity if they are brought to another section as infants. A baby of a different race and language, if adopted by Americans speaking the English language, would learn that language and never know a single word of the language of its parents unless taught that language. The ability to acquire language, then, is a part of man's biological inheritance, while the language he acquires is a question of social inheritance. The degree of excellence which any individual member of the language group displays in language is a result of two factors: (1) the innate ability he has for acquiring language and (2) the efficiency of the methods employed by society in giving language training.

Beginnings of language in the race. We are deprived of direct knowledge concerning the beginnings of languages in primitive man for the simple reason that primitive man as we know him today represents a great advance over the primitive man who lived centuries ago. There is no race today so primitive as not to have a fairly well-developed language, consequently it is impossible to study language in its origin at first hand. Speech probably first arose out of instinctive responses involving the speech organs. In the beginning, speech very likely was concerned largely with emotional expressions: fear, anger, and the like. In this stage the individual used language primarily in communicating his personal feelings and attitudes. Probably following this, or growing up with it, came signs or sounds which were used in conveying information useful to the family or tribe. Written language — picture and sign writing — was developed later and came as a result of the necessity of communicating with other members of the tribe at a distance. The Egyptian is one of the oldest languages of which we have any remains. Records of this language date back several thousand years B.C. It is evident that any language so highly developed as to have written forms must have developed during a long period of time. The origins of spoken language are therefore lost in antiquity.

One method of explaining the origin of language is that primitive man imitated the sounds about him and thus gave names to animals and things. Another theory explains the origin of language in terms of man's innate nature. Certain sounds are universally expressive of emotional experiences and come to stand for those experiences. Whatever the origin of language, there were doubtless at first only a few words by means of which man expressed to his fellows a vague notion of his experiences. As the social need of man increased, there came a need for more exact expression and a wider range of words for communication. Language and social development probably paralleled each other. Language took on a fuller and richer meaning and at the same time the intellectual life of primitive man must have increased.

Beginnings of language in the individual. We cannot too strongly emphasize the fact that language develops in relation to a social environment and not as a spontaneous development of the child. If several children could be isolated so that they never heard any speech, they would learn to communicate with each other in a simple way by sounds and signs, but they would be unable to develop anything more than a very primitive language. It would probably take thousands of years for such children and their descendants, who never came in contact with a well-developed language, to develop one of their own. It is significant to note that each child must start over again in the development of language but that he has a language heritage which he acquires largely through imitating his elders.

Parents generally consider that language begins at the time when the child first makes a sound which is an apparent attempt to communicate its feelings or desires. In reality, language begins much farther back in the life history of the individual. It begins with all those movements and emotions which the infant makes early in life in response to stimuli most of which are internal. Speech — language in general — has its beginnings in such responses. Later, as the individual begins to secure better control over the speech organs, sounds are made which might be considered expressive in that the child apparently attempts to communicate his feelings and wants to others. For some time this form of language is predominant in that words are used almost exclusively for making known the individual's own wants. They always have some personal reference.

Language, then, has its beginning in the innate drives or emotions of the organism. The problem of language in its origin in the individual is a functional one. The question is not what does the individual desire to communicate but what are the needs he is trying to satisfy.

Varying with different children, but generally about the end of the second year of life, a noticeable difference in the child's language reactions may be observed. Previous to this time words have been used singly and always associated with some desire of the child. Now he begins to point to various objects and inquire as best he can the names of the individual things. He has now discovered that everything has a name. His language subsequently begins to take a new turn. Instead of all language reactions being concerned with himself, the things about him receive more of his attention. Words during this period tend to lose for the child the "wish-relationship" and take on more denotive aspects.[1]

How words acquire meaning. The first word of an infant develops out of sounds which it makes in the beginning merely by chance as it reacts to internal and external stimuli. There are certain sounds as "mama" and "dada" which are universally made by young children. These are among the easiest ones for it to produce. Parents have recognized these sounds and guided the child in his word building. He makes such sounds at first by mere chance but parents motivate these by repetition and by paying attention to the baby when the sounds are produced. The appearance of such sounds, like that of the movements of the various parts of the body, is the result of changes produced in the nervous system by stimuli. It is significant that stimuli which lead to no controlled responses produce babbling. All persons who have observed young children have noticed the tendency for certain sounds to occur over and over again. As the speech organs develop and further stimulation takes place, a greater range of sounds and combinations of sounds are produced while at the same time the child begins to secure control over the movements producing these. At this stage of pre-word development sounds are repeated continually.

---

[1] Koffka, Kurt. *The Growth of the Mind*, Chap. V, pp. 319–331. Harcourt, Brace and Company, Inc., New York. 1924.

It is out of this babbling that words grow. As the child secures better and better control of the speech organs and as his babbling is motivated by things and persons, certain sounds begin to have meaning with respect to the stimuli which motivate them. True words or language sounds thus begin to develop. At first such word sounds are probably produced intentionally only when the stimulating object is present. As the child acquires additional language sounds and mental development increases, these responses are freed from the necessity of the presence of the object as a stimulus. True words carrying certain fairly definite meanings to the child are now used. The meanings change as he has additional experiences. A word conveying a certain meaning to the child may have an entirely different one to the adult. Words carry meanings according to the experiences of the individual. An eight-year-old boy with a mental age of six on being asked what cloth is used for replied that it is used to patch clothes with. His experience with cloth was wholly in having his clothes patched. He thus gave his idea of the use of cloth in terms of his experience. So it is with all words, they carry meanings for us in terms of our experience.

Relation between language and mental development. A study of the origins of language either in the race or in the child will reveal the close parallel between language development and mental development. There is no question but that language is a part of man's social heredity while the ability to acquire language rests largely in his biological heredity. Since acquired characters are not inherited, language as such has never become a part of man's native equipment. Biological inheritance has never given any generation a language. It has only given the ability to learn language. Each generation must learn anew from the one preceding it. The new generation, however, has the opportunity of developing and adding new words and expressions to the language learned from the last. Language has thus been built up by slow additions and changes. It is, then, seen to be a product of social inheritance and to be highly artificial. Language and mental development are mutually dependent. Indeed language and mental development, in a sense, refer to the same thing. With language man is able to acquire in a relatively short time a great share of the things discovered in the past. Since an individual grows only as he reacts to the things about him, it is evident that language gives the individual a superior means of reacting and thus makes possible greater mental development.

Relation between language and thinking. One's thinking is conditioned by the tools which he has available for use in the process. Civilization is wholly dependent upon the intellectual development of the race. Intellectual development really means ability to think and this in turn is conditioned by language development. Thinking and language development are so closely related that it is difficult to conceive the one without the other. They seem to refer to one and the same thing. Man's intellectual development would be crude indeed did he not have the power to react in a symbolic way to situations. A high stage of intellectual development would be impossible if man could react only directly to situations. As it is, certain sounds and actions acquire meaning and these stand for situations. Language thus becomes a tool for thought whereby words and gestures are substituted for the original situations. Since man is not faced with the necessity of always having the original situation present when he reacts to it but may substitute language, a great economy is effected. Words become detached from the things they stand for and are used in thought processes instead of the things. It so comes about in the development of an individual that language and thinking become very intimately related in that thinking depends on language of some form.

Language a mode of reaction. Language as a mode of reaction must not be confused with the content of language. The content of language refers to its use as a means of communication with others. As a mode of reaction, language is considered from the point of view of its importance in individual development and adjustment. One of the chief aims of language has to do with individual development. The growth of organisms is conditioned by their ability to adjust themselves to their environment in a satisfactory way. Language is undoubtedly man's most important means of reacting. As such, no other school subject is so important. In early life the child makes known his wants and desires in many ways, often by various motor actions other than those involving the speech organs. In later life language becomes the predominating method of expression. Language provides a universal means in terms of which man may react to the things about him and express to his fellows the interpretation he places on them.

The student must learn to interpret language from the genetic and functional points of view as well as from the more formal ones. Language teachers who have made little or no study of educational psychology are apt to have no concept of their problem other than a formal and artificial one. Such teachers are unable to see the deeper meanings of the development of language in the life of the individual and the race. Language is a hazy, mystical thing for most teachers who do not go to the other extreme and overemphasize its formal aspects. The student of language should see it as a form of human behavior and should have some notion of its origin and affinities in the original nature of the individual and the race.

Language as habit. The child knows how to talk and may use correct expressions long before he speculates about forms. In fact, he may go through life using good English almost — if not totally — unaware that such a thing as formal grammar exists. Language is fundamentally a matter of habit. The child hears others about him use certain sounds to denote objects, actions, etc. Through simultaneous association the sounds come to stand for the objects. Later, he learns to associate these sounds or words in a certain order to convey certain meanings. Language is an exceedingly complicated form of behavior but the child is totally unaware of this. He has learned how to use nouns, verbs, adjectives, adverbs, and other parts of speech so as to make known his wants and to communicate his interpretation of situations to others, but all of this is on a habitual level.

Later, the more mature individual who has learned the nature of language and its use as a tool of thought may consciously control language processes so as to secure more accurate results. He may even invent words and symbols to use for his purposes in solving problems. This consciously controlled language behavior must not be confused with more habitual language behavior. It is a secondary type of behavior based on the primary. In the ordinary conversation of the individual no thought is taken of the words to be used or their order. The situation confronts the individual and the appropriate reaction is made on the habitual level.

The fact mentioned in the preceding paragraph is illustrated in all our conversations. One person in a group makes a statement. The next person may make a long, involved counterstatement, not knowing when he begins talking what words are going to be used or how his statement will end. He simply reacts with a certain point of view, and words are used as a part of the response to the situation set up by the first speaker. Much of our conversation is on this level. No attention is given to individual words unless the language is faulty in some respect, but we react to the thought of the total statement. The speaker is usually not especially concerned with the words used but presents a meaning clothed in words. The conversation may run on and on. The trend of the thought will likely be remembered but the words used will receive no attention except as they are necessary in the process of recall. The use of words is not the object of the conversation. They are used on the habitual level for the purpose of reaction.

Language and social intercourse. Language is our main method of communication and as such is highly socialized. In adult life much of our thinking, even though we are engaged in work apart from others, is of a social nature. People who are working on similar problems or who are interested in problems like our own are continually thought of. Comparison is made between what others have done and the problem we have in hand. Reference is frequently made to methods of work developed by people who have preceded us. In all such references and comparisons the student has in mind other workers. He is motivated to make a more exact and worthy production because of the thought of other students of similar or related problems. He thus comes to be motivated by individuals — it may be at a distance — to whom the product of his inquiry will later be communicated. The reaction of the distant worker is anticipated and the problem is handled in the light of the anticipated response. Language, while highly of an individualistic nature in the pupil entering school, gradually becomes almost wholly social in its nature.

In the young child reactions by means of language are probably on the same level as his other activities. He reacts to the present situation by talking. Much of the talk of a primary child is of an individualistic nature. He talks, just as he reacts in any other motor way, largely in terms of himself and his own activities. Individualized motives predominate. He thinks of himself and merely talks about his own activities with few if any social motives. Not so with the adult. His language activities, as well as his other activities, are almost always, if not always, dominated by social motives. By social motives we do not mean a desire to do what he thinks best for society but merely that he is motivated by the way he thinks others, generally a very limited group, will react to his activities.

Exact expression and word meaning. Closely associated with the thought of the preceding paragraph is the problem of using words to convey exact thought. By "conveying exact thought" we mean the use of words in such a way as to convey the ideas we have in mind so that the individual for whom they are written or spoken will be able in interpreting them to secure our ideas. The fact that the race has not inherited ready-made meanings for words but that each individual has acquired them for himself accounts for the various shades of meaning which are attached to many words. Different individuals often learn the same word under different circumstances and in connection with widely unlike events. The word "farm," for example, does not mean the same to a man reared in West Texas as it means to one reared in Vermont. The word "home" is one which practically all people react to with a warmth of feeling and certain images and ideas, yet how different must be the reaction of a city boy reared on the tenth floor of an apartment house from that of the country boy whose home is surrounded by wide expanses of green fields dotted with trees. It is this fact, that words carry implications according to the different experiences of individuals, which causes much confusion in our interpretation of the language of others.

We limit the meaning of words when they are used in sentences. A word used by itself tends to convey a wider range of meaning than when used in a sentence simply because when so used its meaning is limited by the other words of the sentence. Exact expression occurs when the thought we wish to convey is clothed in carefully chosen words standing in a certain relation to each other and making a language unit which can be interpreted only in the desired way. In such a language unit the words are interpreted in terms of each other collectively and not singly. Just here lies the trouble with most students of a foreign language. Words in a sentence are still words and the student is unable to get the meaning of individual words used in certain relationships.

In this connection, Miss Rowland[1] in her study of words says:

> The tendency in all higher word combinations is to temporarily deprive the words of all associations that do not contribute to the meaning of the sentence as a whole. The span of attention is limited, and if we had as complete a reaction as I have described for each word in a sentence, we should be lost in the meaning of the parts before we could combine them in a whole. We do not give equal value to the different parts of a sentence, but we dwell

---

[1] Rowland, Eleanor H. "The Psychological Experiences Connected with the Different Parts of Speech," *Psychological Review Monograph Supplement*, Vol. VIII, No. 1, Whole No. 32, pp. 36, 37. Psychological Review Company. January, 1907.

on the more important words, while those of lesser interest serve, not as independent words, but simply as parts of the associative cluster that make up the meanings of others.

The highest literary style consists of a nice adjustment of values, where the words mean all that they possibly can, without confusing the combined meaning of them all. On the other hand, scientific style of expression differs, in that the separate words are allowed only as much independent significance as is necessary for the sentence to have meaning. This prevents any doubleness of interpretation, and more can be crowded into a given space. In general, a phrase may become a kind of elongated word and may have meanings in every way analogous to word-units as we have studied them. When these phrase-experiences are described, however, the analysis must fall into the same terms we have used for the word-experiences.

That words are hard to use in an exact way to express an idea accounts in large part for the fact that scientists frequently are forced to develop new words for purposes of exact expression. The mathematician has a set of symbols by means of which he is able to express processes and results so that all other workers in the same field are able to follow him with accuracy. If he does not already have symbols to express his concepts accurately, he invents them. The whole trend in scientific and mathematical work is to build up a language which is denotive only; words that are expressive and carry many meanings for different individuals cannot be used in exact work. "Instinct" is a word which furnishes a good illustration of the difficulty found in using a common term to express a scientific concept. Psychologists are able to define what they mean by instinct and agree fairly well, but when they begin to use the word apart from the definition there is considerable disagreement.

It has been observed that in their conversations persons use a smaller vocabulary than their needs of communication require. All persons use a more familiar word where one which they know but use less often would convey a more accurate shade of meaning. This is true because new words, or those used less frequently, are not so definitely habituated. One's vocabulary is composed of some words which can be used at any time the situation demands while there are others not so definitely under control. "Vocabulary training is not merely the learning of more words, but learning to use words more accurately to convey precise shades of meaning." [1]

Two aspects of language reactions. In an earlier paragraph the fact was mentioned that the language of children is a much more personal thing than that of adults. Children use words more to give expression to desires and attitudes than do adults. Words are more personal with people early in life than later. Here they are used in such a way as to give personal attitude toward situations. Later in life words are used more to express ideas, but they probably always give some hint as to our attitude toward them. Piaget,[1] in his study of the languages of children, divides the talk of his subjects into two groups — "the ego-centric and the socialized." He says:

---

[1] Symonds, P. M., and Penney, Edith M. "The Increasing of English Vocabulary in the English Class," *Journal of Educational Research*, Vol. XV, pp. 93–103. February, 1927.

> When a child utters phrases belonging to the first group, he does not bother to know to whom he is speaking nor whether he is being listened to. He talks either for himself or for the pleasure of associating anyone who happens to be there with the activity of the moment. This talk is ego-centric, partly because the child speaks only about himself, but chiefly because he does not attempt to place himself at the point of view of his hearer. Anyone who happens to be there will serve as an audience. The child asks for no more than an apparent interest, though he has the illusion (except perhaps in soliloquy if even then) of being heard and understood. He feels no desire to influence his hearer nor to tell him anything; not unlike a certain type of drawing-room conversation where everyone talks about himself and no one listens.

This ego-centric tendency in the use of language by children is also noticeable with adults.

The following quotation from Miss Rowland's study emphasizes the same point.[2]

> We find that the adjective function in general is that of expressing the intimate effect of stimuli on organism and at the same time of pointing to an object as possessing these qualities and it is more likely than the other parts of speech to have an affective coloring. It must, if it has any meaning apart from its noun, have a definite content,

---

[1] Piaget, Jean. *Language and Thought of the Child*, p. 9. Harcourt, Brace and Company, Inc., New York. 1926.

[2] Rowland, Eleanor H. *Op. cit.*, p. 23.

which may be in terms of elemental sensations or of the reaction subsequent to these sensations, or a combination of both. When the whole person is felt as involved in the reaction and the sensational content is diffused over enough area, we classify the qualities as opposites, because of the opposite reaction they call up. Such adjective qualities are apt to be felt in terms of the self as experiencing them, instead of in terms of external objects.

In a study of the psychology of language it is important that these two aspects of language, the denotive and the expressive, be clearly recognized. The function of language is more than the communication of ideas. Language also affords a means whereby we may make known our personal attitude toward facts. Words not only carry meanings for us which are similar to the meanings they carry for others, but they in addition possess certain personal characteristics for the user. This is what gives individual warmth and feeling tone to our conversation. The fact that words are closely tied up with the subjective side of life, with the experiences of the individual, is clearly shown by an association experiment. When a word is called out to a number of persons individually, with the instruction that they give the first word that comes to mind, a wide range of reactions is found.

Language as stimulus and response. Weiss[1] calls attention to the fact that when we consider the behavior of the human organism, two rather distinct types of motor responses are discovered: (1) those that involve the manipulation of objects and (2) those that produce language symbols. These responses, each or both, may be produced by every situation the individual meets. The peculiar characteristic of language — the one that makes it of such tremendous importance in the economy of man's behavior — is that sounds or symbols are substituted for things. Man learns to react to objects by the use of sounds and substitutes these reactions for those involving the manipulation of the object. Not only is man able to respond to situations in a secondary way through language, but he is also able to respond to such responses of others. This dual nature of language makes it of the greatest importance for means of both reaction and stimulation. This fact is of especial interest because one individual may react with words to a situation which demands a handling response. The words of the first individual may be reacted to by a second individual who makes the handling response. As Weiss points out, this makes coöperation between individuals possible and may involve many individuals and extend over a long period of time. This character of language has probably been the chief cornerstone of man's socialization.

---

[1] Weiss, A. P. *A Theoretical Basis of Human Behavior,* Chap. XIII. R. G. Adams & Company, Columbus, Ohio. 1925.

QUESTIONS AND EXERCISES

1. Observe a group of persons talking. Notice movements which aid the sounds produced by the speech organs in conveying meaning.

2. Name some bodily movements which aid persons in conveying their feelings to others. Do you find marked differences between children with respect to movements which aid speech?

3. Give examples which illustrate the points discussed under the topic, Biological Basis of Language, page 207.

4. Have you ever had an opportunity to observe the beginnings of speech in a child? If so, can you write a paragraph showing the stages in the development of meaning for a certain word?

5. Observe how you acquire the meaning of a new word. Write sentences which illustrate the various meanings of *fast*. How do you think that you acquired a knowledge of all these meanings? What would you expect the word *fast* to mean to a first-grade pupil?

6. Visit a language class and notice any methods the teacher uses in developing word meaning. List all the instances in which she makes an effort to enlarge the children's vocabulary.

7. If possible secure a measure of the vocabulary of the pupils in the class visited by means of a vocabulary test. Would you expect to find a wide range of language ability in an average class of fifth-grade children? Discuss methods of making provisions for individual differences in language ability.

8. Ask the teacher of the class visited whether the pupils who are best in language ability are also best in the other school subjects. If this is true on the average, does she find any exceptions? What provisions are made for such exceptional cases?

9. If you have available mental test scores and vocabulary test scores, find r for these two sets of data. What is

the relation between language ability and mental ability as measured by the tests?

10. Discuss the efficiency of speech for social intercourse. In this connection discuss the purpose of language instruction.

11. In thinking do you tend to use words subvocally? How do children in the first grade compare with those in the sixth in ability to think silently? What are the causes of the differences found?

12. Can you illustrate the two aspects of language reactions mentioned in the chapter from examples discovered in your observation of children in the elementary school?

SELECTED REFERENCES

1. Conn, H. W. *Social Heredity and Social Evolution*, Chap. II. The Abingdon Press. 1914.
2. Dashiell, J. F. *Fundamentals of Objective Psychology*, Chap. XV. Houghton Mifflin Company. 1928.
3. de Laguna, Grace. *Speech: Its Function and Development*, Part III. Yale University Press. 1927.
4. Jesperson, Otto. *Language, Its Nature, Development, and Origin*. Henry Holt and Company. 1921.
5. Koffka, Kurt. *The Growth of the Mind*, Chap. V, p. 264. Harcourt, Brace and Company, Inc. 1924.
6. Piaget, Jean. *Language and Thought of the Child*. Harcourt, Brace and Company, Inc. 1926.
7. Pillsbury, W. B., and Meader, C. L. *The Psychology of Language*. D. Appleton and Company. 1928.

8. Sandiford, Peter. *Educational Psychology*, Chap. XVI. Longmans, Green and Company. 1928.

9. Sapir, Edward. *Language: An Introduction to the Study of Speech.* Harcourt, Brace and Company, Inc. 1921.

10. Smith, W. A. *The Reading Process*, Chaps. I, II, and III. The Macmillan Company. 1923.

11. Vendryes, J. *Language: A Linguistic Introduction to History.* Alfred A. Knopf. 1925.

12. Watson, J. B. *Psychology from the Standpoint of the Behaviorist*, Chap. IX. J. B. Lippincott Company. 1919.

13. Weiss, A. P. *A Theoretical Basis of Human Behavior*, Chap. XIII. R. G. Adams & Company. 1925.

CHAPTER XII

THE PSYCHOLOGY OF LANGUAGE (*Continued*)

General aims. The general purpose of all work in language must be determined by the function it performs in the life of the race. Man's ability as a reacting organism would be very greatly limited if he did not possess language. He uses language as an efficient method of reacting to situations, and he is able to react to situations described in terms of language. Language in a way provides man with a method of reacting to situations which occurred in the past and which occur today in distant places as well as to those which occur in his immediate environment. It is significant, however, that situations which involve language responses are always social. Man's ability to develop language, and consequently his ability to rise from a primitive to a highly civilized condition, has made of him a socialized being. The general purpose of English teaching must then be found in the part language plays in man's development. Language is man's most useful instrument and one without which most of his progress would not have been possible. The general purpose of language teaching may therefore be stated as follows, "To make the language responses of the pupils more efficient." This is a rather general statement which involves among other things the following: (1) the ability to react accurately to language situations whether oral or written and (2) the ability to produce language which may readily be comprehended by others. To be more specific, the first statement deals with the ability to understand words, phrases, or any group of words, either spoken or written. This involves a knowledge of words and forms of expression together with the meanings they convey when used in different ways. The second statement has to do with both oral and written language and implies that the individual should be able to state his experiences in terms of language so that they may be both accurately and readily understood by others. It is needless to say that the teaching of language is concerned with both the expressive and denotive aspects.

Specific aims in language instruction. General aims set forth a viewpoint and help the teacher to get a general notion of what is to be accomplished, yet it is essential that more specific aims be kept constantly in mind. Language habits are not general, or if general, they are composed of many specific habits which have become organized into a larger functional unit. Training in order to be more effective must be specific. We have had too much use of the "shot gun" method in education. Teachers must have definite objective goals in view; they must know how to attain these goals and how to take inventories of the progress made.

Bobbitt[1] has listed the specific aim of English expression. These are reproduced here because they seem to meet the situation better than any yet proposed and because of their wide influence in molding educational practice.

---

[1] Bobbitt, Franklin. *How to Make a Curriculum*, pp. 252–253. 1924. Used by permission of, and arrangement with, Houghton Mifflin Company.

Objectives of English Expression

1. Ability to use language in all ways required for proper and effective participation in the community life.
2. Ability effectively to organize and present orally one's thought to others: (*a*) In conversation; (*b*) In recounting one's experiences; (*c*) In more serious or formal discussion; (*d*) In oral report; (*e*) In giving directions; (*f*) To an audience.
3. Ability to pronounce one's words properly.
4. Ability in speech to use the voice in ways both agreeable and effective.
5. Command over an adequate reading, speaking, and writing vocabulary.
6. Ability to use language which is grammatically correct.
7. Ability effectively to organize and express one's thought in written form: (*a*) Memoranda; (*b*) Letters; (*c*) Reports, news items or articles, systematic discussion; (*d*) Giving directions; (*e*) Written addresses.
8. Ability to write with proper legibility, ease, and speed.
9. Ability to spell the words of one's writing vocabulary.
10. Ability to use good form, order, and arrangement in all of one's written work: margins, spacing, alignment, paragraphing, capitalization, punctuation, syllabication, abbreviation, etc.

11. Ability to organize and express one's ideas clearly and effectively in the discussion, formal or informal, of social problems.

12. Ability to converse agreeably and effectively upon a variety of topics and in a mood and manner suitable to the situation.

13. Ability to utilize conversation as a profitable and enjoyable means of participating in the thought of the world.

14. Ability and disposition to give expression to one's thoughts and experiences in proper ways and under proper circumstances.

15. Ability to use language efficiently as the vehicle of one's thought.

There are two distinct phases of language work: one has to do with written expression, the other with oral. Both phases are of great importance in the development of the individual. Oral expression is probably the most important but as a rule has not received the attention it deserves. The committee on the reorganization of English in secondary schools lists aims for both oral and written expression. Those for the teaching of oral expression are listed here.[1]

The immediate classroom aims of teaching oral expression may be summed up under the ability: (1) To answer questions intelligently and fully; (2) to converse agreeably; (3) to collect and organize material for oral discourse; (4) to present effectively in a natural environment material already organized; (5) to join courteously and pertinently in informal discussion; (6) to read aloud in such a way as to present the writer's thought and spirit; and (7) for those who have, or hope to develop, qualities of leadership, the ability to address an audience, or to conduct a public meeting.

---

[1] Report, "Reorganization of English in Secondary Schools," *Department of Interior, Bureau of Education*, Bulletin No. 2, p. 87. 1917.

While the aims here stated are probably the best yet given, they are entirely inadequate from the point of view of the individual's own growth. Inglis[1] calls attention to the fact that language is far more important as a means by which the individual's own thinking is aided. Language as a tool for thinking is of more importance than it is as one for the communication of thought because the first is a necessary condition for the second. Language is merely thought expressed in terms of signs and symbols. Then again the individual's experiences are not limited to the particular situations to which he has reacted but through the use of words he is able to combine parts or elements of many situations and generalize. It is from this that rules, principles, and general points of view develop.

Time devoted to English. Scientific curriculum construction has not yet reached the point where a definite answer can be given as to the amount of time which should be devoted to English. Glass[2] made a study of the amount of time actually devoted to each of the school subjects. He found a wide variety of practices. Table XXIII shows his data in terms of percentage of the school week devoted to English by the school systems included in his study. These data were secured from fourteen school systems and probably are representative for the country as a whole. They show that some school systems are devoting practically twice as much time to English as others. No conclusions can be drawn as to the amount of time which should be given since Glass did not attempt to measure the results achieved by the pupils in the different systems.

---

[1] Inglis, Alexander. *Principles of Secondary Education,* Chap. XI. Houghton Mifflin Company. 1918.

[2] Glass, J. M. "Curriculum Practices in the Junior High School and Grades 5 and 6," *Supplementary Educational Monographs,* No. 25, p. 5. University of Chicago, Department of Education.

TABLE XXIII. HIGHEST, LOWEST, AND AVERAGE PERCENTAGE OF THE SCHOOL WEEK DEVOTED TO ENGLISH IN THE FOURTEEN SCHOOL SYSTEMS

GRADE	HIGHEST PERCENTAGE	LOWEST PERCENTAGE	AVERAGE PERCENTAGE
5	31.7	16.7	26.0
6	31.7	15.8	25.3
7	29.1	12.1	19.0
8	32.2	12.1	16.3
9	31.1	12.1	16.5

Growth in language ability. Standardized tests in oral and written expression are limited in number but are increasing rapidly. Although they measure only the more formal aspects of language, they are valuable in that they give a definite idea of the child's growth in language. An examination of the purposes of some of the tests, with their norms of growth, is of value. The Wilson Language Error Test [1] was devised to discover the pupils' ability to recognize and avoid the common language errors. The test consists of three stories, each containing 28 errors which are to be corrected by the pupils. The three stories are of equal difficulty and so may be considered as three forms of the same test and used as alternate forms. Table XXIV below shows the estimated median scores for grades 3 to 12 and Table XXV shows the estimated median age norms.

TABLE XXIV. SHOWING ESTIMATED MEDIAN SCORES FOR GRADES 3 TO 12 ON THE WILSON LANGUAGE ERROR TEST

Grade . . .	3	4	5	6	7	8	9	10	11	12
Median Score	7	11	14	17	20	22	23	24	25	26

TABLE XXV. SHOWING ESTIMATED AGE NORMS

Age . .	7	8	10	11	12	13	14	15	16	17	18	19	20
Score .	10	12	14	16	18	20	22	23	24	25	25	25	25

There are 28 errors in each of the three tests and each error properly detected counts one point. The tables above, therefore, show the pupils' growth in ability to detect errors. Part of Story C of the test is reproduced here for the purpose of illustrating the types of errors involved.

---

[1] Wilson, G. M. *Wilson Language Error Test.* Copyright, 1923, by World Book Company, Publishers, Yonkers-on-Hudson, New York.

Story C

An Accident

One Friday afternoon are teacher she asked us if we wanted to go to the woods. It was an awful nice day. Ain't fun to play in the woods on such day's? There was a old woods near the school house. Lots of flowers was in bloom. John and me wanted to pick them flowers so's we could take some home to Mother, but the others did not wish to wait for us.

. . . .

John's mother give us some apples for bringing him home. There orchard was full of apples. They never had so many before. The apples was picked and lay in great piles under the trees. The apples that we recieved helped to make up for the disappointment in having to come home early.

The norms presented by Huddleson [1] for his composition scale are valuable for the purpose of showing growth. They are given in Table XXVI.

Table XXVI. Showing Norms for Huddleson English Composition Scale

In Grade	IV	V	VI	VII	VIII	IX	X	XI	XII
Quality	3.	3.6	4.2	4.7	5.3	5.5	5.9	6.3	6.7

In this test each sample is measured from a zero point, and each score represents exactly that many steps from the zero point or "just not any" merit. A definite relationship is thus established between the norms for each grade in that the steps are equal. The growth from step 3 to 4 is the same in merit as that from step 5 to 6. A score of 6 represents, then, twice as much composition merit as 3. The difference between the norms for consecutive grades indicates the amount of growth in the ability measured.

---

[1] Huddleson, Earl. "English Composition, Its Aims, Methods, and Measurement," *The Twenty-Second Yearbook of the National Society for the Study of Education,* Part I, pp. 71 and 73. Public School Publishing Company, Bloomington, Ill. 1923.

TABLE XXVII. SHOWING SCORES MADE BY DIFFERENT GRADE GROUPS ON THE STANFORD BINET-SIMON VOCABULARY TEST[1]

SCORE	GRADE					
	1	**2**	**3**	**4**	**5**	**6**
1–10	1					
11–15	5		1			
16–20	8	2	1	1	1	
21–25	11	8	5	1	2	2
26–30	6	9	7	3	3	1
31–35	3	7	7	8	5	3
36–40	1	4	6	7	8	7
41–45		2	3	5	4	9
46–50		1	1	2	4	4
51–55			1		2	4
56–60				1	2	3
61–65				1	1	1
66–70						1

---

[1] *Unpublished Materials*, Jesup Psychological Laboratory, George Peabody College for Teachers.

A number of individuals have devised vocabulary tests. Terman,[1] in the Stanford Revision of the Binet-Simon Scale, has arranged a vocabulary test as part of the scale. The test consists of 100 words arranged in two lists of equal difficulty of 50 words each. The words are arranged approximately from the easiest to the most difficult in each list. The score is the number of words the child knows the meaning of. In order to find the entire vocabulary it is necessary to multiply the number of words the child knows by 180, in case both lists are used; if only one list is used, multiply by 360. The scores made on this test by the pupils of several grades are shown in Table XXVII. These data show that there is a wide range of vocabulary ability within each grade and that there is great overlapping between grades.

TABLE XXVIII. SHOWING GROWTH IN VOCABULARY AS MEASURED BY THE STANFORD BINET-SIMON VOCABULARY TESTS[2]

AGE	NUMBER OF CASES	AVERAGE NUMBER OF WORDS	TOTAL VOCABULARY
6	38	15	2,700
8	55	31	5,580
10	47	43	7,740
12	45	54	9,720
14	31	66	11,880
16	19	76	13,680
18	16	82	14,760

---

[1] Terman, Lewis M. *The Measurement of Intelligence,* p. 226. 1916. Houghton Mifflin Company.

[2] *Unpublished Materials,* Jesup Psychological Laboratory, George Peabody College for Teachers.

Vocabulary growth is shown in Table XXVIII. The average number of words known by the children at the several ages is considerably higher than the norms for the test. Two facts probably explain this: the pupils tested have superior native ability and also have had superior home and school advantages. If the test is reliable, these data show that even young children may possess surprisingly large vocabularies.

Initiative and language training. We are largely creatures of habit. We frequently think of habit in connection with some particular skill or skills we have acquired, as walking and talking, little realizing that our entire existence is for the most part regulated by habits. We start off the day by getting out of bed and dressing in the same way that we have dressed hundreds of times before. We go through the routine of the day largely in the same way. In fact, we develop a habit of acting in the habitual way and avoiding the efforts necessary for new ways of doing things. Because we live largely on an habitual level and learn to take things as a matter of fact, experiences are apt to pass unanalyzed. Speaking and writing help pupils acquire the ability to notice occurrences and to report them with accuracy. Habits of careful observation are developed when the social situation is such as to furnish opportunities and incentives for the development of these habits. To observe carefully and report accurately helps develop good habits of thought as well as good language ability. Initiative in analyzing situations and reporting accurately may become a part of one's habit system; this is desirable.

Language skills needed. The language skills needed will vary somewhat from group to group;

TABLE XXIX. SHOWING THE SIXTEEN SKILLS RECEIVING THE HIGHEST SANCTIONS[1]

1. Skill to read and understand newspapers	6,715
2. Skill to read and understand letters, orders, contracts	5,845
3. Ability to use good penmanship	5,815
4. Ability to spell correctly	5,771
5. Ability to read and to follow directions	5,255
6. Good conversational ability	4,884
7. Skill to read and appreciate good books	4,811
8. Ability to think clearly and cleverly	4,521
9. Ability to read and to understand the magazines	4,450
10. Persuasive skill	4,413
11. Skill to direct the work of others	3,743
12. Skill to pronounce words accurately	3,677
13. Skill to gather, organize, and interpret facts	3,515
14. Ability to present facts clearly	3,458
15. Ability to read and understand descriptions of goods	3,145
16. Ability to write good business letters, forms, briefs, and reports	3,068

however, there is no doubt but that there are certain basic skills which are needed by everyone capable of acquiring them. Searson[2] studied the skills needed by people in various vocations. He found that the sixteen skills listed in Table XXIX received the highest rating. In the study 7752 persons were consulted. The number to the right of the skill indicates the number of times it was mentioned.

---

[1] Searson, J. W. "Determining a Language Program," *The English Journal*, Vol. XIII, p. 103. February, 1924.

[2] Searson, J. W. *Op. cit.*, pp. 99–114.

Are children interested in language work? The interest children have in any subject is determined by many factors such as teachers' interest, desire to see definite improvement from time to time, a knowledge of just what is required in the assignments, ability to finish a task and know that it is correctly done, and ability to make objective comparisons with one's own former work and that of others. Language work because of its complexity and rather subjective nature does not lend itself well to the development of interest. When compared with other subjects it ranks low in student preference. Terman[1] studied the preference of gifted and average children for the various school subjects. He found that gifted girls liked composition; for the other groups, however, composition, grammar, and penmanship were either disliked or the pupils were indifferent toward them. In a study of children's interests in the school subjects Sister M. Columba[2] found the subjects in the language group to be the most disliked. Her data, together with those from two other studies which she quotes, are given in

---

[1] Terman, L. M. *Genetic Studies of Genius*, Vol. I, Chap. XIII. Stanford University Press. 1925.

[2] Sister M. Columba. "A Study of Interests and Their Relation to Other Factors of Achievement in the Elementary School Subjects," *Educational Research Bulletin*, Vol. I, No. 7. The Catholic Education Press. 1926.

Table XXX. It is evident from the data presented that language, if not positively disliked, is one of the subjects liked least by children. There must be a reason for this state of affairs. Certainly there is little if anything in the nature of the subject itself to warrant the condition. If these data are typical and if to like a subject is as important as to know it, we have failed in the teaching of English when this is compared with the accomplishment in the other subjects.

TABLE XXX. SHOWING RANK OF PREFERENCE OF SCHOOL SUBJECTS

WASHINGTON DATA	LOBSIEN	BRANDELL
1. Religion	1. History	1. History
2. Arithmetic	2. Arithmetic	2. Reading
3. History	3. Reading	3. Arithmetic
4. Spelling	4. Geography	4. Religion
5. Geography	5. Penmanship	5. Geography
6. Language	6. Religion	6. Language
7. Reading	7. ———	7. Spelling
8. Penmanship	8. ———	8. Penmanship

Interest and achievement in language work. Do pupils who express a preference for a subject do better work in that subject than in one which is disliked? Terman[1] found a correlation of .763 between intelligence and achievement when intellectual interest was eliminated and one of .49 between intellectual interest and achievement when the effect of intelligence was eliminated. Sister Columba[1] found that the pupils in the group preferring language and grammar to the other subjects do not as a rule excel in language and grammar. In discussing the reason for this fact, which is contrary to that found for the other subjects, she says:

---

[1] Terman, L. M. *Op. cit.*, p. 480.

> They liked spelling because it was easy; history and geography furnished them with vicarious experiences; arithmetic gave promise of future success and opportunities for definite achievement. In their experience with English no pleasure, immediate or future, was offered and no need was accentuated, hence their antagonistic attitude toward it. Reading, looked upon merely as a tool, produced a similar attitude. In this age of typewriters every one will concede that it is a difficult task to interest boys and girls in penmanship.

Interest and experience in language work. Theme work should have a purpose. To assign a theme simply because the course of study calls for composition work on certain days or at certain intervals is psychologically wrong. Expression grows out of interests and experiences and has little relation to a formal program of assignments. In this connection the material presented in the preceding paragraph is of interest. Although the language teacher carries a heavy burden, she should find means of correlating the work in oral and written expression with the other work of the school and with the pupils' outside interests and activities. Too often pupils are at a loss as to what to write or speak about when they really have a wealth of material available. They have been assigned artificial tasks and told to draw on their imagination until they have developed the habit of thinking that language work has no relation to their everyday experiences. Many teachers in fields other than language do not have a proper perspective and are largely to blame for this condition since they themselves too frequently see language teaching merely from the content side. One of the chief functions of the language teacher is to help develop the ability of students to use superior methods of thinking. This means developing efficiency in the use of language symbols and it further means developing better methods of reacting in problem situations. From this viewpoint, language teachers have a very definite relation to the work of the whole school.

---

[1] Sister M. Columba. *Op. cit.*, p. 31.

The interests and experiences of the pupils should determine the nature of language work. In this connection it is interesting to note the preferences of high school students as to the choice of theme work. Smith[1] made a study of the preferences of junior high school pupils. Her results are found in Table XXXI, which is reproduced from her study. The material in the table represents the expression of the pupils as to first preference, second, and so on. It is very hard to classify themes into definite divisions and there is undoubtedly much overlapping. However, the table shows that certain types of themes rank high in point of preference while others rank low.

---

[1] Smith, Dora V. "The Danger of Dogma Concerning Composition Content," *The English Journal*, Vol. XV, No. 6, pp. 414–425. The University of Chicago Press. June, 1926.

TABLE XXXI. COMPOSITION PREFERENCES. VOTES REPRESENTING 10,000 STUDENTS IN 30 JUNIOR HIGH SCHOOLS (GIVEN IN PERCENTAGES)

RANKING	1	2	3	4	5
I. Personal Experience Topics	70.	23.4	0.0	6.7	0.0
II. Imaginative Themes	20.	36.6	23.4	10.0	10.0
III. How to Do or Make Things	6.7	13.4	43.3	10.0	26.6
IV. Current or Community Problems	0.0	13.3	20.0	40.0	26.7
V. School Expeditions and Community Enterprises	3.3	13.3	13.3	33.3	36.7

Motivation of composition work. The teacher is probably the biggest factor in determining whether children become interested in language work. A live teacher who knows boys and girls, who knows how to discover their interests, who is sympathetic toward their point of view, and who by her enthusiasm can create an atmosphere of enthusiasm should have no trouble in leading pupils to a desire for superior accomplishments in English. Teachers have given too much attention to the technical and formal aspects of language and not enough to the idea that language is a vehicle by means of which boys and girls may give to others an accurate and clear notion of how they feel toward and interpret situations. Teaching should be such that pupils get a knowledge of what the true nature of language is.

From the way they are taught students get an idea that language is something forced upon them by society. Few boys and girls realize that language develops in the individual according to his needs.

Children like, as a rule, to construct things which they can see. Language has been taught so as not to emphasize its objective characteristics. The construction, in connection with a history or a language lesson, of a model of a ship in a detailed and accurate way, so as to convey a notion of the original, is often a fascinating activity in the grades as well as in the high school. Language work should have the same meaning to children. How may a description be so worded as to convey an accurate picture of the ship described?

The first principle in theme building whether oral or written should be: every theme based on pupils' interests. Every boy and girl has some interest which the skilful teacher may find. At least until a good social working spirit is developed in the class the work should consist largely of building up class morale and coöperation. Gradually, the teacher will find the common interests of the pupils and out of these the language work should come. Thompson[1] studied in the Cleveland High School the difference between two methods of teaching composition, the traditional academic method and the socialized method. His analysis of the difference between the methods shows that it is largely one of motivation and has to do with:

---

[1] Thompson, C. J. "A Study of the Socialized *vs.* the Academic Method of Teaching Written Composition," *The School Review*, Vol. XXVII, pp. 110–133. University of Chicago, Department of Education. 1919.

1. The nature of the situations in which the learner is placed.
2. The nature of the problems growing out of the situations.
3. The form in which the themes are written.
4. The nature and the amount of publicity given to compositions.
5. Controlling and directing the attention of the learner.
6. The nature of the stimuli which drive the learner to make the best use of his practice period.

The essential difference seems to be one of form and function or between artificiality and naturalness. The socialized method places emphasis on use. Themes are written to be read to or by classmates. Subjects which are of interest to others are selected and greater publicity is secured because papers are written to be read. Composition then becomes a problem of expression, of communicating ideas. In the traditional academic method, attention and effort are focused more on form, fluency, unity, and coherence. The socialized method does not neglect these factors as desirable aims but seeks to attain them through different means. The motivating factor is the social situation and not some writing quality which the pupil is trying to attain.

Building desirable attitudes. Closely connected with the subject of the preceding paragraph is that of attitudes. Probably no problem of instruction is of more importance than that dealing with the development of desirable attitudes toward school work. In fact, before the school can function properly the community must have proper attitudes toward its work. Attitudes are learned in the same sense that English usage is learned. It is necessary to remember the psychology of habit formation here because attitudes are not spontaneous but are acquired according to the definite principles of learning. They are harder to describe because the reactions which we call attitudes are mainly subjective. The development of desirable attitudes is a matter largely of setting up school situations to which children respond favorably rather than unfavorably. Here again the teacher is a large factor, perhaps the determining one. In a situation to which children would otherwise react unfavorably they will frequently react favorably because they have high regard for the teacher.

Factors which aid in establishing desirable attitudes on the part of the pupil toward matters of English usage have been summarized by Shepherd[1] as follows:

1. Instruction should be individualized to meet the specific needs of each pupil, and the pupil should be kept

---

[1] Shepherd, Edith M. "The Attitude of Junior High School Pupils toward English Usage," *The School Review*, Vol. XXXIV, pp. 575–586. University of Chicago, Department of Education. October, 1926.

conscious both of his need and of his opportunity to receive instruction.

2. Pupil responsibility for using what is learned in the English class should be emphasized in every possible way.

3. Coöperation of other departments with the English department should be secured and made obvious to the pupils by such devices as the following:

a. Sending papers from science, geography, art, and other classes to the English room for practice material.

b. Using such rather than, or in addition to, English papers as a basis for securing evidence of pupil needs and pupil progress, and making sure that pupils know their papers are being used.

c. Encouraging pupils to be interested in matters of usage in general and in their own problems in particular.

d. Encouraging pupils to ask for help in matters that puzzle them — for example, in correcting mistakes marked by teachers of the other subjects.

e. Giving publicity to every phase of coöperation, encouraging and commending it at every opportunity.

f. Encouraging and commending efforts at self-correlation as the prime evidence of approaching mastery, the goal of effort.

g. Maintaining favorable writing and speaking conditions in other classrooms, especially —

(1) Time (even for slow pupils) to write without haste.

(2) Time and encouragement to proofread all papers.

(3) Requirement of no more than a reasonable amount of written work.

(4) Clear consciousness in pupils that careless or slovenly work will not be accepted by the teacher.

The proper attitude toward good usage is a matter of habit formation. When careful writing is emphasized by the teachers of all the subjects, we may expect pupils to build up habits of correct usage. However, as long as teachers of the other subjects accept work in which poor English is used, we may expect undesirable attitudes toward English usage. A pupil should, at appropriate times and in appropriate ways, be checked on usage in every subject throughout his whole school career.

Grammar and language. The formal study of grammar is an inheritance from the time when the classical languages dominated the high school curriculum. As the vernacular came to play a more prominent part in the school curriculum it is but natural that methods used in studying Latin should be adopted in the study of English. For a number of years the study of formal grammar was not questioned. In fact, English teaching secured a more prominent place in the work of the school as a result of the criticism of the value of Latin while it was in reality being taught in about the same formal way. The trouble with the study of formal grammar is that it seems to have little functional value. If the child grows up in a good language environment, he develops habits of correct usage, little realizing that his speech conforms to a highly complicated and rigid set of rules and principles.

A number of studies[1] have been made as to the influence of grammar on correct usage. These have shown that little relationship exists between knowledge of formal grammar and correct usage. Asker[1] says in summarizing his experiment:

---

[1] Pressey, S. L. "A Statistical Study of Children's Errors in Sentence Structure," *The English Journal*, Vol. XIV, No. 7. September, 1925.

> The facts in this investigation show, then, that knowledge of formal grammar influences ability to judge the grammatical correctness of a sentence and ability in English Composition only to a negligible degree. . . . We may, therefore, be justified in the conclusion that time spent upon formal grammar in the elementary school is wasted as far as the majority of students is concerned, and the teachers of English Composition must seek some other reason for the alleged generally poor ability in this subject than the neglect of formal grammar in the grade school.

In the same connection Snedden[2] says:

> It seems highly probable that such a study is of no value whatever to students of less than median intelligence. It is probably also of little or no value to pupils of superior intelligence who have as yet developed no substantial interests in linguistic proficiency.
>
> The systematic study of formal grammar, therefore, should be offered as an elective in junior and senior high schools to those coming from whatever sources who have acquired genuine interests in the subject and are able to show decided progress as a result of their election of such courses.

In view of the fact that experimental results have shown the value of formal grammar study negligible, when measured in terms of usage, and in view of the psychology of habit formation, it seems that emphasis should be placed on carefully controlled drill for habit formation.

---

[1] Asker, Wm. "Does Knowledge of Formal Grammar Function?" *School and Society*, Vol. XVII, pp. 109–111. 1923.

[2] Snedden, David. *What's Wrong with American Education?* p. 297. J. B. Lippincott Company. 1927.

TABLE XXXII. SHOWING PER CENT OF ERRORS IN EACH CLASS

1.	Use of a wrong verb or auxiliary	18%
2.	Failure of a verb to agree with subject	15%
3.	Misspelling	11%
4.	Syntactical redundance	8%
5.	Connecting sentences by commas or using periods after parts of sentences	7%
6.	Confusion of tenses	6%
7.	Mistakes in principal parts	4%
8.	Use of wrong parts of speech	4%
9.	Mistakes involving pronouns	4%
10.	Misplacing of modifiers	3%
11.	Lack of agreement of pronouns with antecedent	3%
12.	Use of wrong case	3%
13.	Mistakes in form or use of comparative and superlative	3%
14.	Use of dangling participle	3%
15.	Use of wrong preposition or conjunction	2%
16.	Miscellaneous	6%

Studies of errors. An analysis of the abilities of pupils in order to find where instruction should begin is one of the most important procedures which psychological education has developed. A number of workers have attempted to determine through a study of errors where training should be given. In a study of errors extending over six weeks Tressler[1] found 700 errors made by a group of second-year and a group of fourth-year high school pupils in written and oral English. Table XXXII was constructed from his data. An examination of the errors shows that they fall into a few classes.

---

[1] Tressler, J. C. "High School Grammar," *The English Journal*, Vol. VI, pp. 645–657; 584–594. University of Chicago Press. November and December, 1917.

TABLE XXXIII. SHOWING PERCENTAGES OF ERRORS IN EACH GRADE DUE TO EACH OF THE EIGHT CLASSES OF MISTAKES

CLASSIFICATION OF ERRORS	GRADES						
	3	4	5	6	7	8	TOTAL
1. Verbs	44.2	60.	55.4	55.9	43.3	48.2	49.9
2. Pronouns	15.2	14.	6.7	7.7	12.3	18.8	13.5
3. Negatives	11.5	7.1	20.2	7.3	15.2	14.	11.6
4. Syntactical Redundance	8.	6.6	11.2	12.6	16.5	9.6	9.7
5. Mispronunciations	14.7	7.8	2.2	4.9		1.7	8.
6. Prepositions	3.4	3.2	1.8	5.6	4.1	2.6	3.5
7. Adjectives and Adverbs	2.	.6	2.2	6.6	8.2	4.8	3.3
8. Ambiguous Expressions		.2					.2

Sears and Diebel[1] report a study of errors made by children as reported by teachers who were requested to keep a list of errors made through a certain period of time. Table XXXIII shows the per cent of errors in each grade due to the eight classes of mistakes.

---

[1] Sears, Isabel, and Diebel, Amelia. "A Study of the Common Mistakes in Pupils' Written English," *The Elementary School Journal*, pp. 44–54. University of Chicago, Department of Education. November, 1917.

The table shows that far more mistakes are made in class 1, verbs, than in any of the others. All eight grades are fairly even in inability to use the correct forms. There seems to be little gain from grade to grade except in pronunciation. Correct pronunciation is a trait which is likely to be emphasized by the child's social environment as well as in school. It is entirely possible that mispronunciations are remedied more largely out of school than are the other kinds of errors.

Sentence structure. The sentence represents a complete reaction to some situation. As we read a paragraph we notice that the writer takes up various aspects of a central thought and clarifies these as he goes from sentence to sentence. The various sentences always amplify the central theme of the paragraph. When the paragraph is finished, the writer has presented various situations all of which aid in giving a notion of a larger situation, the paragraph. The sentence, then, represents a psychological unit and nothing shows the relation between thinking and language better than does a study of the sentence. The writer who uses long and awkward sentences is giving a true picture of his mental processes. Our written sentences are, of course, only our own reactions set down so that others may know how we react to a given situation. Sentence organization, then, is to be judged by two standards: (1) whether the writer or speaker has sufficient skill to think clearly as shown by his sentences and (2) whether the reader or hearer is able to get the thought expressed.

Errors in sentence structure have been studied by a number of students. Pressey's[1] study may be reviewed here because it is one of the best and most thorough. In this study Pressey attempted to determine the frequency of different types of errors in sentence structure. The study was based on a total of 980 papers (182,985 words), written by pupils in grades VII–XII. His conclusions are given below:

1. Errors in sentence-structure appear to be about as common in the last two years of high school as in the seventh and eighth grades.
2. In general, errors in sentence-structure are of a few, frequently recurring types. The most common errors persist throughout high school, and appear in the writing of college students.
3. Two general types of error, failure to make proper sentence division (as shown in stringy sentences, and in use of fragments for sentences) and omission of words or phrases made up approximately one half of all the errors.
4. Two other types of errors — faulty reference of pronouns and redundancy — are also common.
5. Errors in sentence-structure are very important, since they make reading difficult, and often lead to confusion as to meaning; they are important also because of the intimate relation between difficulties in sentence-structure and errors in punctuation and capitalization.

---

[1] Pressey, S. L. "A Statistical Study of Children's Errors in Sentence Structure," *The English Journal*, Vol. XIV, No. 7. University of Chicago Press. September, 1925.

The errors found in the study are listed in Table XXXIV. The most important feature to be noted is the apparent lack of improvement from grade to grade. As Pressey points out, sentence structure is not a simple subject like punctuation or capitalization. For those skills the teacher is able to locate errors and drill for mastery. This is not true with sentence structure. With maturity the thinking of children becomes more and more involved and consequently the sentences become longer and much more complicated. These more complicated sentences offer greater possibilities for errors than do the simple short sentences of younger children.

TABLE XXXIV. SHOWING FREQUENCY OF EACH TYPE OF ERROR, PER 10,000 WORDS IN THE WRITTEN WORK OF 980 CHILDREN IN GRADES VII–XII

USAGE	GRADES				
	VII–VIII	IX–X	XI–XII	Average	%
Fragments used as sentences	6	6	5	6	11
Stringy sentences	31	14	13	19	33
Choppy sentences	1	2	3	2	4
Lack of parallel construction	1	3	5	3	5
Pronouns with no antecedent	4	9	4	6	11
Pronoun not near antecedent	3	5	3	4	7
Change in tense	1	3	8	4	7
Redundancy and repetition	3	4	2	3	5
Omitted word or phrase	1	4	3	3	5
Generally incoherent sentence	2	2	5	3	5
Miscellaneous	3	6	2	4	7

Investigators of errors in sentence structure agree in the main in their findings. Pressey[1] lists the errors in order of frequency as follows:

Stringy sentences
Omissions
Faulty references of pronouns
Redundancy
Change in tense within the sentence
Lack of parallel construction for parallel ideas, dangling modifiers
Modifiers not near word modified

Individual differences. Few people realize the enormous difference in language ability between pupils in the grades. Table XXXV shows scores made on the Nassau County Supplement to the Hillegas Composition Scale[2] by pupils in the junior and senior high school of a small school system. The most significant thing shown in the table is the wide range of ability in various grades. As far as ability in composition as measured by the scale is concerned, almost any kind of transfer of pupils could be made between the grades.

The outstanding things shown in the table are: (1) the wide range of ability found in each grade, (2) the overlapping between grades, and (3) the small difference between the medians from grade to grade. It will be noticed that the range tends to decrease as we go from the seventh to the twelfth

---

[1] Pressey, S. L. *Op. cit.*, p. 531.

[2] Trabue, M. R. "Supplementing the Hillegas Scale," *Teachers College Record*, Columbia University, Vol. XVIII, 51. January, 1917.

TABLE XXXV. SHOWING DISTRIBUTION OF COMPOSITION SCORES (NASSAU COUNTY SUPPLEMENT OF HILLEGAS SCALE) FOR A SMALL JUNIOR AND SENIOR HIGH SCHOOL[1]

SCORE	GRADE					
	7	8	9	10	11	12
8.5		1		1	1	2
8.	1	1	1	1	2	2
7.5	2	2	3	3	2	4
7.	1	1	2	2	4	7
6.5	3	2	1	4	6	5
6.	3	6	7	6	5	5
5.5	4	4	3	4	3	1
5.	4	5	4	2	4	1
4.5	5	2	3	2	2	1
4.	3	3	3	1	1	2
3.5	2	1	1	1		
3.	2	1	1			
2 5		1	2			
2.	1	1				
1.5						
Medians	5.4	5.7	5.9	6.3	6.9	7.1

grade. There is little increase at the seventy-fifth percentile from one grade to the next. The large overlapping from grade to grade is significant. In this connection Huddleson[2] quotes Thorndike:[3]

---

[1] *Unpublished Materials*, Jesup Psychological Laboratory.

[2] Huddleson, Earl. "English Composition, Its Aims, Methods, and Measurement," *The Twenty-Second Yearbook of the National Society for the Study of Education*, Part I, pp. 71 and 73. 1923.

[3] Thorndike, E. L. "Notes on the Significance and Use of the Hillegas Scale," *The English Journal*, Vol. II, pp. 551–561. November, 1913.

> The paragraph writing of pupils in our high schools and that of the world's hundred best English writers undoubtedly overlap considerably in merit. . . . In the judgment of high school teachers of English, the worst tenth of paragraph-writing of high school pupils is still nearly half-way from zero toward the best the world knows. What we rightly consider a mediocre composition still represents nearly three fourths of the progress possible.

Measurement and diagnosis. The measurement of language work is especially difficult because of its subjective nature. So far only the most formal aspects yield themselves to measurement. There is danger in this. Since the formal aspect can be measured, teachers are apt to stress too greatly the mechanism of language to the neglect of the expressive side. In taking measurements and making diagnoses, the student should remember that all drill is for the purpose of developing better methods of expression and not for the mechanical accuracy *per se*. Because of limitations of space only types of tests can be discussed here. Several tests have already been mentioned in a preceding paragraph. The Hillegas Composition Scale[1] is our oldest composition scale, having been constructed in 1912. It is of interest because it pointed the way for additional scales and because a number of those constructed recently are revisions of it or are modeled somewhat after it. The Nassau County Supplement to the Hillegas Scale has probably been used more than any other. This scale represents ten

---

[1] Trabue, M. R. *Op. cit.*, p. 51.

Table XXXVI. Number of Pupils in Grades 3 to 8, Missing Each Error in the Wilson Language Error Test B

Grade	3	4	5	6	7	8	
Number in Class	21	18	13	18	23	11	Total
1. John he	21	13	4	9	3	2	52
2. awful good	17	16	8	13	15	5	74
3. he ask-ed	20	18	9	14	14	5	80
4. once't	19	7	5	6	7	1	45
5. learn — teach	16	16	12	10	9	3	66
6. on — in	20	13	5	9	6	2	52
7. he saw	20	15	6	10	13	2	65
8. git — get	14	10	4	11	6	0	45
9. got — were	14	9	4	18	19	11	75
10. seen — saw	13	9	4	12	3	0	38
11. hain't get	14	18	3	6	7	2	50
12. no — any	20	17	6	11	3	3	60
13. haven't none	20	10	9	10	1	1	51
14. is — are	20	10	4	12	10	4	60
15. give — gave	19	17	5	15	9	5	70
16. et — ate	12	10	4	2	7	0	35
17. done — did	18	17	6	11	8	1	61
18. sit — set	18	11	7	11	7	1	55
19. hisself	19	11	8	14	10	0	62
20. good — well	21	16	6	18	20	7	88
21. git — get	18	12	6	11	8	1	56
22. to — too	21	18	12	18	21	9	99
23. and went for to go	21	16	10	15	21	7	90
24. can't never	20	16	9	11	11	0	64
25. is — are	18	14	4	8	0	0	45
26. seen — saw	18	10	2	13	5	1	49
27. had came	21	14	10	13	14	1	73
28. have got	20	18	12	13	14	3	80
29. are — our	20	16	12	14	16	2	80

steps of merit in composition ability. The first seven compositions on it were written by elementary school pupils. The scale yields a single score. The Cross English Test[1] is composed of eight parts as follows:

I. Spelling (32 items)
II. Pronunciation (32 items)
III. Recognizing a Sentence (40 items)
IV. Punctuation (15 items)
V. Verb Forms (16 items)
VI. Pronoun Forms (12 items)
VII. Idiomatic Forms (10 items)
VIII. Miscellaneous Faulty Expressions (15 items)

The test is probably worth very little for comparative purposes but should be very valuable as a means of diagnosis. There are three forms of the test: A, B, and C. These forms are supposed to be equivalent. The writers found form B slightly harder for a group of 64 high school seniors. A reliability coefficient of 82 was secured when the tests were given at an interval of two weeks.

The Pressey Diagnostic Tests in English Composition are published in two forms and may be used from the seventh grade through college. There are four tests in each of two forms: Capitalization, Punctuation, Grammar, and Sentence Structure. The test is especially valuable if administered at the beginning of the year and tabulations of the errors made. Pupils should be furnished with a

---

[1] Cross, E. A. *Cross English Test.* World Book Company.

TABLE XXXVII. SHOWING THE PARTICULAR ERRORS MISSED BY EACH PUPIL, OR CONVERSELY THE PUPILS MISSING EACH ERROR, TEST B, WILSON LANGUAGE ERROR TESTS, PRELIMINARY FORM (ADAPTED FROM WILSON)[1]

ERROR	NUMBER OF PUPIL																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
John he												×	×		×		
awful good	×	×	×	×		×		×		×	×	×	×	×			×
ask for asked			×	×		×		×			×	×	×	×		×	×
once't			×										×	×	×	×	
learn for teach	×		×					×			×		×	×		×	×
on for in			×	×													×
had saw			×	×				×		×	×		×		×	×	
git for get			×	×				×						×			
got for were	×	×	×	×	×		×	×		×	×	×	×		×	×	×
seen for saw	×		×										×				
hain't got	×		×	×	×									×			
no for any			×							×	×			×			
haven't none			×														
is for are			×	×				×			×	×	×	×		×	×
give for gave			×	×								×		×		×	×
et for ate			×														
done for did				×						×			×	×	×	×	×
sit for set			×										×	×		×	
hisself	×			×						×		×		×	×	×	×
good for well	×	×	×	×	×	×		×	×	×	×	×	×	×	×	×	×
to for too	×	×	×	×	×	×	×	×		×	×	×	×	×	×	×	×
git for get		×	×	×				×						×		×	
and went for to go	×		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
can't never	×	×	×			×		×		×	×		×	×		×	
is for are																	
seen for saw	×			×									×				
had came			×	×	×	×		×		×	×		×	×		×	×
have got	×	×	×	×	×			×		×	×		×	×			
are for our	×	×	×	×	×	×		×		×	×	×	×	×	×	×	×
No. Pupils' Errors	13	8	24	19	8	8	3	15	2	13	14	11	19	20	10	17	14

---

[1] *Ibid.*

statement as to their weaknesses, and the work of the class as well as the individual work should grow out of the needs of the pupils as discovered by the test and as revealed by the work of the pupil through the year.

After standardized or informal tests are given for diagnostic purposes, it is necessary to make some sort of tabulation of errors so that proper remedial measurements may be applied where they are needed. Tables XXXVI and XXXVII show how tabulations may be made. These tables are based on results secured by Wilson[1] through the use of the Wilson Language Error Test. Table XXXVI shows how a test may be used to locate the rooms or grades poor in the ability to use language correctly. In the same way grades or schools in different parts of a city or county may be studied. The table shows how the pupils in a grade who need training in certain language habits may be located. Standardized and informal tests may be used in like fashion for the purpose of locating weakness in any of the many phases of language work.

QUESTIONS AND EXERCISES

1. List the general aims of language teaching.
2. Compare the percentage of time devoted to English in one of the grades in the elementary school with the percentages given in Table XXIII, page 235.

---

[1] Wilson, G. M. "After Test Value of Language Error Tests," *The Second Yearbook of the Department of Elementary School Principals*, pp. 378–379. July, 1923.

3. Secure a set of composition papers and grade them according to the Nassau County Supplement to the Hillegas Composition Scale.

4. Study the variability in the grade by noting the number of pupils one year ahead or behind the norm for the grade. What provisions should be made for such pupils?

5. What methods may be used in motivating language work? In your observation of English teaching, what motives have you found teachers using?

6. In your observation of teaching, have you noticed any efforts on the part of teachers to build desirable attitudes toward language? List all such efforts. How do you think the general situation in this respect might be changed?

7. Elaborate on the idea that the "sentence then represents a psychological unit." What is meant by "sentence sense"?

8. What are the chief methods which have been used in studying errors in sentence structure? What are the advantages of keeping a list of errors made by a group of children?

9. Ask a teacher whether the pupils who are most interested in their language work are also the best pupils in it.

SELECTED REFERENCES

1. Cameron, E. H. *Educational Psychology*, Chap. XVIII. The Century Co. 1927.
2. Certain, C. C. *Teaching English with Standardized Tests*, Parts I and II. Edwards Brothers. 1927.
3. Charters, W. W. "Minimum Essentials in Elementary Language and Grammar," *The Sixteenth Yearbook of the National Society for the Study of Education*, Part I, pp. 85–110. 1917.

4. Edwards, A. S. *The Psychology of Elementary Education,* Chap. XV. Houghton Mifflin Company. 1925.
5. Freeman, F. N. *The Psychology of the Common Branches,* Chap. IV. Houghton Mifflin Company. 1916.
6. Huddleson, Earl. "English Composition, Its Aims, Methods, and Measurement," *The Twenty-Second Yearbook of the National Society for the Study of Education,* Part I. 1923.
7. Pressey, S. L. "A Statistical Study of Children's Errors in Sentence Structure," *The English Journal,* Vol. XIV. September, 1925.
8. Reed, H. B. *Psychology of Elementary School Subjects,* Chaps. XV, XVI, XVII, and XVIII. Ginn and Company. 1927.
9. Sears, Isabel, and Diebel, Amelia. "A Study of the Common Mistakes in Pupils' Written English," *The Elementary School Journal.* November, 1917.
10. Starch, Daniel. *Educational Psychology* (Revised), Chap. XIX. The Macmillan Company. 1927.
11. Thompson, C. J. "A Study of the Socialized *vs.* the Academic Method of Teaching Written Composition," *The School Review,* Vol. XXVII, pp. 110–133. 1919.
12. Tressler, J. C. "High School Grammar," *The English Journal,* Vol. VI, pp. 645–657; 584–594. November and December, 1917.
13. Wilson, G. M. "After Test Value of Language Error Tests," *The Second Yearbook of the Department of Elementary School Principals.* July, 1923.

CHAPTER XIII

READING

Importance of reading. When we consider the work of the school and what its function is, we are forced to the conclusion that reading is the most important of the school subjects. Reading makes it possible for the individual to secure from permanent records experiences which otherwise he would not receive. Thus he is able to enter into the life of the community and think and act in situations which are available to all the members of the community. Again, all future school achievements are conditioned by the reading activity of the child. Reading is the key which unlocks for the learner the materials of the content subjects. Since this is true, good reading ability is necessary for successful school work. From a third point of view — that which is concerned with the development and growth of the individual — reading habits considered in the broadest sense are the most important of all those given by the school. Reading makes it possible for the individual to work independently and to condition his own behavior through situations which otherwise would never be available for him. Proper development depends on reaction to the right kind of situations. Through reading, the individual is able to acquire information and points of view in an economical and superior way.

Reading objectives in general. As modern psychology better understands the individual and his environment and is able to formulate more wisely methods for his development, our educational objectives change with our better understanding of him and of his relation to the world at large. W. S. Gray [1] has pointed out that the content and method of reading as formerly taught were determined largely by three aims, as follows: "to master the mechanics of reading, to develop habits of good oral reading, and to stimulate keen interest in, and appreciation of, good literature." Today, however, with a better knowledge of the principles of the development and growth of the individual and an educational psychology which emphasizes the importance of intelligent participation in the activities of the group both for the sake of the group and for the sake of the individual's own development, a restatement of the aims of reading is necessary.

The more general objectives of any school subject may be stated in a broad way by telling (1) how the subject contributes to the growth of the individual receiving training and (2) how it aids him to participate in the activities of society. Of the more general objectives of reading, the primary one is that the ability to read extends the range of the individual's power to come in contact with situations and to be influenced by them. The individual is thereby able to profit from materials and ideas which otherwise would not be available to him. Furthermore, because of the wider range of experiences provided through reading, the individual should be more capable of participating in an intelligent way in the affairs of the community. Thus, the primary objective of reading is to enable the child to secure a wider range of experiences which contribute to his self-development and help him to become a more useful member of society. The secondary objectives relate to the habits, attitudes, interests, and skills which are essential for efficient reading. These will be discussed in a later paragraph.

---

[1] *The Twenty-Fourth Yearbook of the National Society for the Study of Education*, Part I, pp. 9–19. Public School Publishing Company.

What is reading? To one who has not analyzed the processes involved, reading, like most forms of behavior, appears to be a very simple form of activity. It seems an easy matter to pick up a newspaper or magazine and follow the thought of an article. Careful analysis, however, will reveal the fact that reading is one of our most complex forms of behavior. It is an intricate process evolved out of many simpler ones, most of which in themselves are very complex. This is well illustrated when we read a sentence or paragraph and then attempt to list all the things that make it possible for us to get the thought of the material read. If we take the separate words, we find that in a different combination they may convey an entirely different meaning. Reading involves among other things a knowledge of the meaning of words when used separately and when used in a sentence. It further involves the ability to interpret the thought of a passage composed of a number of sentences. Reading, then, is a form of interpretation in which the reader is able to react to printed or written language symbols by securing the meanings found in the sentence or the paragraph. Some of the elements involved in the ability to read may be listed as follows:

1. The understanding of words.
2. The understanding of sentences.
3. The understanding of larger units of reading material composed of many sentences.
4. A broad background of experience which facilitates interpretation and appreciation.
5. The ability to read fluently and, in case of oral reading, expressively.

Reading and studying. Reading is a term sometimes reserved for the mechanics of reading while studying is thought of as a form of intensive reading.[1] In the content subjects reading is used as a means to an end. The emphasis is not on the mechanics of reading but on the thought expressed. In reading ordinary materials easily comprehended, the content is understood as the words are perceived. No effort is needed to follow the writer, and critical analysis and judgment of the ideas expressed are not required. In studying, on the other hand, the student has a definite purpose which involves the necessity of handling the materials so as to achieve a desired end. Reading, like studying, is used in a wide variety of situations and the uses made of it in one situation may differ very greatly from those made in another.

---

[1] Courtis, S. A. *Journal of Educational Research*, Vol. IV, p. 287, No. 4. November, 1921.

Monroe[1] studied the types of learning in which reading is the central activity used by pupils in the junior and senior high school grades. He gives the following list of types:

I. Comprehension of material read plus memorization so that it can be reproduced.

II. With the text at hand preparation of a summary which contains the central ideas of the assignment studied.

III. With the text at hand preparation of an outline which gives the principal points and supporting details arranged to show order of relation to each other.

IV. Obtaining information for the purpose of solving problems or answering questions.

V. Extension of one's range of general information by reading widely material directly related to a given subject.

VI. Discovery of collateral or illustrative materials for topics or problems under discussion.

VII. Enlargement of vocabulary.

VIII. Appreciation of the significance of each word used in a concisely expressed statement or principle.

IX. A clear comprehension of the essential conditions of a problem which is to be solved.

X. Discovery of new or supplementary problems related to the topic being studied.

XI. Drawing valid conclusions from given data or statements.

XII. Following directions with accuracy and reasonable speed.

---

[1] Monroe, W. S. "Types of Learning Required of Pupils in the Seventh and Eighth Grades and in the High School," *University of Illinois Bulletin*, Vol. XIX, No. 15. 1921.

Monroe also studied the frequency and difficulty of the twelve methods of learning. His data show that the different types of learning are of different degrees of difficulty and importance in school work. These facts seem to indicate that pupils must receive training in reading according to the purpose for which they are to read. A large part of the training in studying which pupils receive should be devoted to the development of skill in reading different types of material for different purposes.

Reading and the other school subjects. Reading is to be regarded as a tool subject. It is not taught for its own sake but because it is a means to the realization of the larger aims of education in general and the more specific aims of the various subjects in particular which contribute to the larger aims. Educational psychologists [1] have called attention to the fact that pupils who develop the ability to read one type of material effectively may not be able to read other types of materials. The content and purpose of the reading determine the technique used. It is imperative that teachers know not only the general reading ability of students as measured by standardized reading tests but their specific reading ability for the type of content under consideration as well. A part of the work in any subject is the development of methods of work in that subject. To see that the pupil masters the technical vocabulary of the subject as well as other language techniques peculiar to it is the particular duty of the teacher of the subject.

---

[1] Judd, C. H., and Buswell, G. T. "Silent Reading: A Study of the Various Types," *Supplementary Educational Monographs*, No. 23. November, 1922.

The relation existing between ability in reading and certain subjects as found by Miles[1] is given in Table XXXVIII. It will be noted that there is a rather wide difference in the measures of relationship found. Judd and Buswell[2] studied reading habits of pupils for different types of material. The records of two of their subjects are presented in Tables XXXIX and XL because they show very definitely that pupils do not read all types of materials equally well.

TABLE XXXVIII. SHOWING CORRELATION BETWEEN READING ABILITIES IN CERTAIN SUBJECTS (CORRELATIONS CORRECTED FOR ATTENUATION)

READING	ENGLISH	LANGUAGE	MATHEMATICS	CIVICS AND HISTORY
Group X	.58	.66	.38	.325
Group Y	.58	.18	.42	.029
Group Z	.64	.36	.65	.26
Average	.60	.40	.48	.20

The data in the two tables show that individuals vary widely in reading habits for different types of material. Subject G. H., for example, has a much

---

[1] Miles, D. H. From *Contributions to Education*, Vol. I, p. 296. Copyright 1924 by World Book Company, Publishers, Yonkers-on-Hudson, New York.

[2] Judd, C. H., and Buswell, G. T. *Op. cit.*, p. 23.

Table XXXIX. Record of Subject G. H. in Silent Reading of Different Kinds of Passages

Type of Material	Average Number of Fixations per Line	Average Duration of Fixation Pauses	Average Number of Regressive Movements
Fiction	6.1	5.7	3.0
Geography	7.3	5.9	1.1
Rhetoric	8.6	6.0	1.5
Easy Verse *	9.4	6.1	1.9
French Grammar	10.6	7.5	2.3
Blank Verse *	11.9	6.8	2.6
Algebra	12.5	6.6	3.1

* Since the lines in the passages of poetry are not equal in length to the lines in the prose passages, the number of fixations is weighed so as to correspond to the number that would appear if the lines were of the length of those in the prose passages.

Table XL. Record of Subject L. M. in Silent Reading of Different Kinds of Passages

Type of Material	Average Number of Fixations per Line	Average Duration of Fixation Pauses	Average Number of Regressive Movements
Fiction	8.5	4.9	2.1
Geography	11.2	5.2	3.2
Rhetoric	11.7	5.0	3.7
Easy Verse	13.1	5.0	3.7
French Grammar	14.1	5.1	4.0
Blank Verse	16.8	5.2	6.1
Algebra	14.4	5.3	4.5

smaller average number of fixations per line while L. M. has a smaller duration of fixation pauses and is much more consistent for different types of material.

Judd and Buswell state that this subject is regular because he has reached "approximately the lower limit of duration for a reading pause." These experimenters state further:[1]

> Teachers know that whenever pupils pass from one kind of reading matter to another there is a change in the rate of reading. This change in rate is conditioned by a change in the number and duration of fixations. The rate is not significant in itself, but as an indication of differences within the subject's mental life it is a matter of the largest interest to teachers.
>
> What is needed, in addition to a knowledge of the gross fact of change in rate, is insight into the complex of facts which cause the change in rate. Teachers need to know that some pupils require for improvement training in rapid observation while others require training in the experiences which will supply the ideas necessary to facilitate interpretation. Above all, teachers need to realize that a slow rate of reading shows that the pupil's equipment is in some respects incomplete.
>
> School methods must be devised which will help pupils to improve their reading far beyond the point which is now ordinarily thought of as constituting the terminus of instruction in reading. There ought, for example, to be technique of teaching high-school students to read algebra fluently and intelligently. There ought to be teaching methods of reading science. These higher applications of reading ability are not to be ignored or thought of as automatically provided for by the training given through the reading of fiction or poetry.

---

[1] Judd, C. H., and Buswell, G. T. *Op. cit.*, p. 26.

Children's interests in reading. During the past few years a number of psychologists have attempted to determine scientifically (1) the interest of children in reading; (2) types of material possessing the qualities that arouse interest; and (3) what the qualities are which make reading materials interesting. One of the earliest studies was made by Wissler.[1] He obtained from a number of pupils the names of the books they like best. His results showed that children of different ages selected different materials and that there were sex differences worthy of note. Miss Dunn[2] studied the interest factors in primary reading by selecting a large number of samples of materials suitable for the first three grades. These materials were classified by experts into ten groups on the basis of interest for children. A number of the selections were then read to pupils and they expressed their preferences. After the preferences were expressed by the children the selections were again submitted to adult judges who ranked them from 1 to 7 for each of twenty qualities which had previously been found stated in textbooks as desirable for children's literature. Miss Dunn arrived at the following conclusions:

> Characteristics which may be expected to cause interest in primary children are, it appears, *surprise* and *plot* for

---

[1] Wissler, Clark. "The Interest of Children in the Reading Work of the Elementary Schools," *Pedagogical Seminary*, Vol. V, pp. 523–540. April, 1898.

[2] Dunn, Fannie W. "Interest Factors in Primary Reading Material," Teachers College, Columbia University, *Contributions to Education*, pp. 46–47. 1921.

both sexes, *animalness* for boys, and *childness*, *familiar experiences*, and to a lesser degree *repetition* and *conversation* for girls. It is significant that the interest value of *surprise* outranks that of *plot*, since thereby a large amount of factual material, lacking the story element, but abounding in elements of wonder and *unexpectedness*, is of promise as affording interesting reading matter for primary children. That *childness* only slightly adds to interest for boys means, conversely, that selections dealing with adult characters will probably appeal to them as much as incidents dealing with children.

For several of the elements here evaluated, the statistical findings are quite at variance with generally accepted ideas. The unfavorable effect of *liveliness*, particularly for boys, is one of the most surprising facts revealed by the process of partial correlation here applied. Far from adding to interest, as the crude correlations and common opinion would indicate, it detracts. It is probable that if a story moves at too rapid a rate, the imagination of the little child cannot keep pace with it, and, missing one salient point after another, soon finds itself groping in a maze of jumbled ideas, a situation which is sure to prove annoying. . . . That *fancifulness* adds nothing, but perhaps derogates from interest, is also not in accord with the popular idea. Much emphasis is laid in pedagogical writings upon the value of fairy tales for their imaginative values, their appeal to the fancy, their freedom from the carping confines of realism. The indication of this study is that it is not the fancifulness of the fairy lore that causes its appeal, but other interest factors which it possesses, such as *surprise*, *plot*, *childness*, *animalness*, or *familiar experience;* and that true or realistic selections, equally possessed of these desirable characters, would be equally interesting.

Uhl[1] studied the desirable and undesirable qualities of selections found in school readers, the best selections, and their proper placement in the grades. The most important undesirable qualities reported by teachers in response to questionnaires were: too mature; hard words; unfamiliar subject matter; abstract or hard symbolism; no story; lacks action; unreal; too long; scrappy; too sad; too childish; tired of it; monotonous; not told well. The desirable qualities, as arranged by Gray[2] from Uhl's material, is given in Table XLI. A study of the table is worth while and will reveal a shifting of interest from grade to grade. Several qualities increase in importance in the higher grades while others decrease.

Jordan[3] studied, by means of questionnaires and by checking lists of books borrowed from libraries, children's reading interests over a period of years and in widely different localities. He found that while the children in one locality were not always interested in the same material they were interested in the same types of material. Boys selected books and magazines dealing with adventure more than all other types combined while the girls selected those dealing with fiction.

---

[1] Uhl, W. L. *The Materials of Reading*, Chap. VI. Silver, Burdett and Company. 1926.

[2] Gray, W. S. "Summary of Investigations Relating to Reading," *Supplementary Educational Monographs*, No. 28, p. 169. June, 1925.

[3] Jordan, A. M. *Children's Interests in Reading*. The University of North Carolina Press, Chapel Hill. 1926.

TABLE XLI. SHOWING RELATIVE FREQUENCIES OF THE MOST IMPORTANT QUALITIES OF READING SELECTIONS[1]

QUALITY	GRADE							
	I	II	III	IV	V	VI	VII	VIII
Dramatic action, adventure, and heroic .	14	19	23	27	28	28	28	28
Interesting action (not dramatic)	11	11	9	9	8	10	11	12
Humor	7	6	6	7	8	10	11	10
Fairy and supernatural	9	13	13	14	11	9	5	5
Interesting characters, home life or child life	7	6	8	12	14	14	13	13
Interesting problems or character study .	3	5	7	8	10	11	13	14
Kindness and faithfulness	8	9	10	10	10	8	9	8
About animals and personification . .	16	13	10	6	5	3	3	3
Availability for dramatization	10	8	7	4	3	3	3	3
Interesting repetition	14	9	5	1	1	1	1	1
Interesting information	1	1	2	2	2	3	3	3
Total	100	100	100	100	100	100	100	100

Another study which is of special interest because it deals with gifted children was made by Terman and Lima.[2] Two of their tables are quoted. In this study there were two groups of children. One group, the gifted children, was composed of those rated high in mental ability, the other of unselected children. This latter group may be thought of as average. In Table XLII data are presented showing the reading done by the members of the two groups as estimated by teachers of the children. It will be seen that the figures are in terms of reading more or less than the average. At every age the gifted children read far more than the average. The type of material read is shown in Table XLIII.

---

[1] Rearranged by Gray from Uhl's data. By permission of the University of Chicago, Department of Education, and Silver Burdett and Company.

[2] Terman, L. M., and Lima, Margaret. *Children's Reading*, pp. 53; 61, 62 D. Appleton and Company. 1926.

TABLE XLII. READING ESTIMATES FOR GIFTED AND CONTROL GROUPS[1]

Per Cent Reading More than Average			Per Cent Reading Less than Average		
Age	Gifted Per Cent	Control Per Cent	Age	Gifted Per Cent	Control Per Cent
8	79	30	8	00	23
9	90	43	9	00	18
10	91	34	10	00	17
11	91	31	11	00	20
12	88	40	12	00	28
13	79	21	13	00	26
14	88	38	14	00	22

It will be noticed from the investigations referred to here that a large amount of valuable work has been done on the general problem of children's interests in reading and in the placement of selections in the grades. Certain steps have been taken (notably by Uhl and Dunn) to locate the desirable and undesirable qualities of various selections. It is not enough to know what selections or types of material children are most interested in. The fact that the material children read varies so much with locality indicates that the interests and activities found in a particular locality influence to a large extent the reading of the children. Home conditions, moral and intellectual attainments, the teacher's preference, and many other factors influence children's interests in reading.

---

[1] Terman, L. M., and Lima, Margaret. *Op. cit.*, p. 53.

TABLE XLIII. PERCENTAGE OF BOOKS READ BY TYPES[1]

	GIFTED BOYS PER CENT	CONTROL BOYS PER CENT	GIFTED GIRLS PER CENT	CONTROL GIRLS PER CENT
Fairy Tales, Folk Tales, and Legends	8	5	12	5
Nature and Animal Stories .	9	4	6	6
History, Biology, and Travel .	6	3	6	2
Science	4	0.5	1	0.2
Stories of Adventure or Mystery (mostly boy's juveniles and series books)	49	63	15	22
Stories of Home and School Life (mostly girls' books) .	2	3	31	33
Poetry and Drama	1	0.1	1	0.2
Children's Encyclopedias . .	1	0.1	1	0.1
Informational Fiction, including the Classics	19	11	14	9
Emotional Fiction (the popular novel and love story) .	1	6	11	19

---

[1] Terman, L. M., and Lima, Margaret. *Op. cit.*, p. 61.

Relation of reading and intelligence. Many pupils are unable to progress in school because they do not have the mental ability necessary to master the mechanics of reading to a sufficient degree and to grasp the meaning of difficult content material. Reading achievement which is satisfactory for a section of a grade at a certain level of intelligence might not be satisfactory for another section with a different level of intelligence. The writers have been keeping the records of a number of children in the Peabody Demonstration School for several years. Results from group intelligence tests and the Stanford Revision of the Binet-Simon Tests have been correlated with scores from a number of reading tests. Some of the correlations are shown in Tables XLIV–XLVI. These data show that there is a rather high correlation between scores made on reading tests and intelligence during the same semester. The Stanford Binet-Simon Tests and the Thorndike-McCall Reading Scales give rather consistent coefficients regardless of whether the tests were given during the same semester or at an interval of three years. The National Intelligence Test does not give such a consistent coefficient but gives a higher one when the testing is done within a short interval. That a higher coefficient is secured here is probably due to the fact that the National Intelligence Test is largely a language test. The coefficients secured with the Monroe Silent Reading Test are worthy of note. Here again higher correlation is found with the National but the coefficients between comprehension

TABLE XLIV. SHOWING RELATIONSHIP BETWEEN NATIONAL INTELLIGENCE TEST I.Q.'S AND THORNDIKE-MCCALL READING SCALE T SCORES

INTERVAL BETWEEN TESTS	COEFFICIENT OF CORRELATION	NUMBER OF SUBJECTS *
1 week	.74	217
1 month	.69	213
1 year	.62	108
2 years	.59	174
3 years	.52	143

* The 143 pupils in the column below took all the tests during the three years. The difference between 143 and 217 represents the number of pupils who had left school or did not take all the tests for some other reason.

TABLE XLV. SHOWING RELATION BETWEEN NATIONAL INTELLIGENCE TEST I.Q.'S AND THORNDIKE-MCCALL READING SCALE T SCORES

INTERVAL BETWEEN TESTS	COEFFICIENT OF CORRELATION	NUMBER OF SUBJECTS
Same Semester	.68	108
1 year	.63	108
2 years	.60	174
3 years	.60	142

and the Stanford Binet-Simon are more consistent over a period of years. It is significant that the Stanford Binet-Simon is no more consistent when correlated with rate than is the National Intelligence Test.

Terman and Lima,[1] in the study referred to in a previous paragraph, discuss the desire and ability

---

[1] Terman, L. M., and Lima, Margaret. *Op. cit.*, pp. 61, 62.

TABLE XLVI. SHOWING RELATION BETWEEN NATIONAL INTELLIGENCE TEST I.Q.'S AND STANFORD BINET-SIMON I.Q.'S AND MONROE SILENT READING TEST SCORES FOR DIFFERENT INTERVALS

INTERVAL	N. I. T. WITH		STANFORD B.-S. WITH		NUMBER OF SUBJECTS
	Monroe Rate	Monroe Comprehension	Monroe Rate	Monroe Comprehension	
Same Semester	.74	.64	.52	.61	108
1 year	.63	.61	.48	.62	108
2 years	.60	.53	.45	.59	173
3 years	.59	.57	.36	.59	141

of the gifted children to learn to read at an early age. They found that nearly half of the gifted children included in their study learned to read before they entered school. They further found that intelligence influences not only the age at which children learn to read but also the amount read and its quality and range. The gifted child reads over a much wider range than the average and he reads much less fiction and more informational material. It was found that a book read and liked at eleven years of age by the average child would likely be read and enjoyed by a gifted child much younger. In discussing Tables XLII and XLIII Terman and Lima say:

> Certain differences stand out very clearly. A larger proportion of the books read by gifted boys than of those read by control boys fall in the field of science, history, biology, travel, folk tales, nature and animal stories,

informational fiction, poetry, drama, and encyclopedias, a smaller proportion in the fields of emotional fiction and stories of adventure and mystery. Almost exactly the same differences are found between gifted and control girls, except that here the two intellectual groups show about the same degree of preference for nature and animal stories.

QUESTIONS AND EXERCISES

1. Why does society lay so much stress on the development in the child of the ability to read? How can this be justified? What does reading do for the child?

2. Discuss the statement that the "ability to read extends the range of the individual's power to come in contact with situations and to be influenced by them."

3. Take some word as an illustration and show how its meaning is limited by the other words in the sentence. The word *last* is a good one to use. What does it mean to you when it stands alone? How is its meaning limited by its use in a sentence?

4. Give examples illustrating the difference between reading and studying.

5. Find r for reading and for another school subject from the data listed in Table VIII, page 61.

6. Visit a grade and inquire of the teacher concerning the individual reading interests of the children of the grade. Many teachers keep records of the reading done by each child. If such records are available, note the difference between the record of a good pupil and the record of a poor one. Also note any differences between the records of the boys and the girls.

7. Attempt to list your own reading interests at 10, 15, and 18 years of age.

8. Why do you think bright pupils enjoy reading more than dull pupils?

9. In your observation in the elementary school, do you find that the pupils who are superior in reading are also superior in the other school subjects? Are those best in reading best in arithmetic also? In the social studies?

SELECTED REFERENCES

1. Anderson, C. J., and Davidson, Isobel. *Reading Objectives*, Chaps. I and II. Laurel Book Company. 1928.
2. Brooks, F. D. *The Applied Psychology of Reading*, Chaps. I and II. D. Appleton and Company. 1926.
3. Dearborn, W. F. "Psychology of Reading," Columbia University, *Contributions to Philosophy and Psychology*, Vol. XIV, No. 1. 1906.
4. Dunn, Fannie W. "Interest Factors in Primary Reading Material," Teachers College, Columbia University, *Contributions to Education*, No. 113. 1921.
5. Gray, W. S. "Summary of Investigations Relating to Reading," *Supplementary Educational Monographs*, No. 28. June, 1925.
6. Harris, Julia M., Donovan, H. L., and Alexander, Thomas. *Supervision and Teaching of Reading*, Chaps. I to IV. Johnson Publishing Company. 1927.
7. Jordan, A. M. *Children's Interests in Reading*. The University of North Carolina Press. 1926.
8. Judd, C. H., and Buswell, G. T. "Silent Reading: A Study of the Various Types," *Supplementary Educational Monographs*, No. 23. November, 1922.

9. Klapper, Paul. *Teaching Children to Read*, Chap. I. D. Appleton and Company. 1926.
10. Miles, D. H. In *Contributions to Education*, Vol. I, p. 296. World Book Company. 1924.
11. O'Brien, J. A. *Reading: Its Psychology and Pedagogy*, Chap. I. The Century Co. 1926.
12. Stone, C. R. *Silent and Oral Reading*, Chap. I. Houghton Mifflin Company. 1922.
13. Terman, L. M., and Lima, Margaret. *Children's Reading*, Chap. I. D. Appleton and Company. 1926.
14. Uhl, W. L. *The Materials of Reading*, Chap. VI. Silver, Burdett and Company. 1926.
15. Wheat, H. G. *The Teaching of Reading*, Chaps. I and II. Ginn and Company. 1923.
16. Yoakum, G. A. *Reading and Study*, Chaps. I, II, and III. The Macmillan Company. 1928.

CHAPTER XIV

PSYCHOLOGICAL FACTORS INVOLVED IN READING

Reading a highly complex form of behavior. Reading is a very complex form of behavior consisting of a large number of more elementary habits. Many of these elementary habits or skills may themselves be analyzed into still more elementary ones. A knowledge of these and of how they function in reading ability is of value to the teacher. No scientific procedure for teaching reading is possible until a psychological analysis of the process of learning to read is made. Huey[1] says, "To the average reader the process by which he gets his pages read is not very much better understood than was the performance of Livingstone by the savages. Indeed, until twenty-five years ago, science could not give a very much better specific account." Huey's statement made twenty years ago concerning the average reader holds true today and in many cases teachers of reading understand the psychological factors involved in reading little better than the average reader.

There are few phases of human behavior in which psychological work has been more fruitful than in reading. The teacher is now able to secure information concerning many problems vital to the acquisition of the ability to read, the existence of which a generation ago was almost entirely unknown. It will be the purpose of this chapter to discuss some of the more fundamental acquisitions which enter into that complex form of behavior known as reading. It must be remembered that the reading habits involved will vary according to the purpose for which one reads. The clearest line of demarcation between different kinds of reading is that drawn between oral and silent reading. Psychological research has clearly shown that good ability in one does not of necessity insure similar ability in the other. Both oral and silent reading may be further divided into different types which are determined by the purpose of the reader. Another line of demarcation frequently made is that between recreatory reading and work-type reading. Here again the investigations have shown that different elements may be involved in the two types.

---

[1] Huey, E. B. *Psychology and Pedagogy of Reading*, p. 5. 1908. By permission of The Macmillan Company, publishers.

Some of the more fundamental acquisitions entering into reading are:

1. Word knowledge
2. Interpretation of words standing in relation to each other (sentences, phrases, etc.)
3. A wide recognition span
4. A wide eye-voice span
5. Fixation pauses of short duration
6. Accurate recognition
7. Rapid recognition
8. Sufficient motivation and interest in reading
9. Accurate and rhythmical movements of the eyes along the line and back to the beginning of the next one

10. Habits of interpretation
11. Suppression of vocalization and lip movements in silent reading
12. Good oral expression in oral reading
13. Organization and reproduction
14. Recognition and interpretation of the mechanics of the page (punctuation, italics, etc.)
15. The technique of locating materials in reference books, etc.

Distinction between oral and silent reading. One of the most important results of the recent psychological research into the nature of the reading process is that which has resulted in the now universally recognized differences between oral and silent reading. In the past, silent reading was largely neglected below the high school and no specific efforts were made even after pupils reached high school to guide them in developing skill in this type of reading. There are several reasons why oral reading predominated in the schools. Oral reading at one time played an important part in social life. With the rise of modern amusements it has ceased to be as important as formerly. Also books were formerly not so plentiful as today and there were fewer people who could read fluently. Thus it came about that one person read to a group. Oral reading is also much more objective than silent and the technique for teaching oral reading was developed more readily than that for silent.

A major difference between oral and silent reading is that words seen do not always convey the same meaning as those seen and heard. In the primary grades spoken and written words more nearly convey the same meanings than at any later time. This is due to the fact that the pupil builds his seen vocabulary from his oral. His meanings have all been acquired in connection with spoken language and these are carried over directly to printed. This simple relation which exists in the first grade soon gives way to one in which varying degrees of relation may exist.

The difference in the development of silent and oral reading is shown by Buswell's[1] data, as arranged by Gray,[2] on the average number of fixations and regressive movements per line in silent and oral reading. (See Table XLVII.) It is significant that after the first two grades the average number of fixations per line is smaller for silent reading, which means that the reader on the average has a wider recognition span for silent reading. This is one of the fundamental differences between the two types of reading. Gray interprets the data with respect to regressive movements as follows:

> The large number of regressive movements in oral reading in the upper grades, high school, and college is due to the fundamental difference in the two types of reading. In oral reading each word must be vocalized, and its pro-

---

[1] Buswell, G. T. "Fundamental Reading Habits: A Study of Their Development," *Supplementary Educational Monographs*, No. 21. June, 1922. University of Chicago, Department of Education.

[2] Gray, W. S. "Summary of Investigations Relating to Reading," *Supplementary Educational Monographs*, No. 28, pp. 77 and 85. 1925. University of Chicago, Department of Education.

nunciation as well as its meaning must be recognized. Furthermore, the voice is unable to pronounce the words as rapidly as the eye recognizes them. Consequently, the eye is restrained in its forward movement and not infrequently moves to the left in order to refresh the mind with the exact sequence of words, to verify the pronunciation of a word, or to wait until the voice more nearly overtakes the eye. Regressive movements of these types are not common until pupils have made considerable progress in the rapid recognition of words and groups of words.

Table XLVII. Showing Growth of Certain Habits in Oral and Silent Reading

Grade	Average Number of Fixations per Line in Silent and Oral Reading		Average Number of Regressive Movements per Line in Silent and Oral Reading	
Grade IB	Silent Reading	Oral Reading	Silent Reading	Oral Reading
Grade IB	18.6	16.0	5.1	4.4
Grade IA	15.5	14.5	4.0	3.1
Grade II	10.7	12.0	2.3	2.5
Grade III	8.9	10.4	1.8	1.8
Grade IV	7.3	10.3	1.4	2.0
Grade V	6.9	8.7	1.3	1.4
Grade VI	7.3	8.9	1.6	1.4
Grade VII	6.8	8.7	1.5	2.0
Freshman	7.2	9.1	1.0	1.5
Sophomore	5.8	8.3	0.7	1.5
Junior	5.5	8.0	0.7	1.1
Senior	6.4	9.3	0.7	1.4
College	5.9	8.4	0.5	1.2

Too much emphasis upon oral reading builds up habits of vocalization and other habits which are detrimental to comprehension and speed in silent reading. Because this is true there has been a very decided shift in emphasis from oral to silent reading. Oral reading has a place in the development of the individual and there is some danger that the schools will neglect it in their emphasis on the teaching of silent reading. However, it must be recognized that both oral and silent reading are forms of behavior made up of many more elementary ones and that skills entering into one form of reading may not enter into the other. This makes it imperative for teachers to recognize that training in one kind may not be of aid in the other and may even be detrimental.

Silent reading. The primary purpose in silent reading is thought getting. Silent reading may be either of the work type or recreatory, but, whatever its nature, the purpose is to help the reader solve some problem, gain information, enjoy a piece of literature, or it is for some other purpose which chiefly concerns the reader. As previously stated, reading whether oral or silent is a very complex process. The factors which have so far been emphasized in the literature on reading are rate and comprehension. Other factors like organization and remembrance are important but have not been studied so thoroughly as rate and comprehension, probably because these last two are more easily studied in a quantitative way.

Oral reading. The idea predominant in oral reading is that of getting the thought for the purpose of transmitting it to others. The primary values are social or recreatory. In addition to the two factors rate and comprehension, such factors as proper pronunciation, interpretation, and expression with respect to the comprehension and attitudes of those listening are important. Factors peculiar to oral reading, such as expression, have not been studied so thoroughly as rate and comprehension in the case of silent reading. This is due probably to the fact that they are not so susceptible to measurement.

Knowledge and Skills Influencing the Development of Comprehension

The ability to get thought from the printed page is the chief test of reading ability. Strictly speaking, thought is brought to the printed page by the reader and the language symbols on the page merely serve as stimuli which arouse the appropriate learned responses. These responses, arousal of word meaning, eye movement, and the like, may all be considered specific learned responses which are combined into the total reading response. A knowledge of the fundamental habits which enter into the larger activity known as reading is one of importance for the teacher because it is only through the development of these that children are able to read. As is already known, we cannot train for general habits except as more specific ones are developed which function together. Some of the more important specific factors entering into the development of comprehension as gathered from the literature on the subject by Gray[1] are:

1. Vocabulary or word meaning
2. Fluency and span of recognition
3. Anticipation of meaning
4. Analysis, association, and judgment
5. Organization
6. Reproduction
7. Rate
8. Interest and motivation

Reading readiness. Most teachers now know that many children have not reached the stage of reading readiness when they come to school and proceed accordingly. This is in marked contrast to former practices where children were immediately set to work with books. Modern child psychology has emphasized the importance of the early experiences of children and the fact that later interests grow out of earlier ones. It has emphasized also that later experiences must be based on earlier experiences and a later program for desirable development must be based on an earlier one.

Children enter school with various degrees of development with respect to reading readiness. There are children who come from homes where reading is one of the chief activities. The parents or older brothers and sisters engage in reading a great deal. The young child is read to frequently and shown pictures. He is probably told stories about pictures and is encouraged to make up stories about them. His vocabulary is wide and his sense of meaning accurate because he has engaged in conversation upon a wide range of topics. Furthermore, such a child frequently comes to school with a desire to read. He probably brings books with him and is fond of books.

---

[1] Gray, W. S. *Op. cit.*, Chap. X.

Frequently other children are not so fortunate. They have never come in contact with people who read and have never acquired an attitude which regards books as possessions to be highly prized. Their experiences which aid in learning to read are meager. These children enter school with experiences, habits, and attitudes quite different from those first described. They must be given a background of experience which will lead to a readiness for reading. The wise teacher will carefully study her children and adapt her program to their needs. It would be just as poor psychology to hold back the child with the first type of experience as to attempt to teach the second to read without adequate experiences out of which the reading activities may grow.

When children enter school, a careful study should be made of them and their home conditions. Those children who are in an advanced stage of readiness for reading should be grouped together and similar groups made for those who are at other stages. It was stated above that to hold a child back and to continue to give pre-reading experiences when he has the attitudes and desires which make him ready for reading is poor teaching. This kind of procedure is likely to give the child such a distaste for school as to affect permanently his whole school career. On the other hand, the child who is not ready for reading may be equally damaged by not being given pre-reading experiences.

The Twenty-Fourth Yearbook[1] lists six types of experiences and training essential to rapid progress in reading as follows:

1. Wide experience, provided in harmony with the interests of children and preparing them to understand the stories and activities about which they will read.
2. Reasonable facility in the use of ideas; that is, ability to make use of past experience and information in conversation, in solving simple problems, and in thinking clearly about the content of what they read.
3. Sufficient command of simple English sentences to enable pupils to speak with ease and freedom. This in turn aids them in anticipating the meaning of passages and in reading fluently.
4. A relatively wide speaking vocabulary which enables them to recognize quickly the meaning of words and groups of words.
5. Accuracy in enunciation which insures right habits in the first reading experiences and eliminates the need of corrective exercises later.
6. A genuine desire to read, which aids in the interpretation of passages and which supplies motives that carry pupils through many difficult periods.

---

[1] *The Twenty-Fourth Yearbook of the National Society for the Study of Education*, Part I, p. 27. 1925. Public School Publishing Company.

Psychology of word meaning. All language involves both symbols and meanings. Very early in life the child begins to give meanings to the various activities and things about him. He develops certain movements and attitudes as responses to the situations with which he comes in contact. He early becomes conditioned so that he gives the same response to the same situation. Thus the word "light" soon takes on meaning because the young child is early stimulated by a bright light and the adults about him begin to encourage him to notice it. Later, they point to a light and say "Light! Light!" In this way the sound becomes associated with the object. Thus, later in the child's life the spoken word and the printed symbols come to be associated in a somewhat similar way with the object. Still later, the symbol comes to carry the meanings formerly connected with the spoken word and the object.

By the time the child is old enough to enter school he has acquired a large stock of words which convey to him definite meanings and he is able to use words so as to make his attitudes and wants known to others. There is an ever-increasing range of experience because he perceives and understands situations which are more complex. He is able to enlarge his range of experience more readily because he now can manipulate symbols in response to situations in the place of objects. He can also make situations out of symbols — words — to which others may respond. Thus he is more easily and readily able to add to his store of meanings. Buswell,[1] in discussing the relation of meaning vocabulary to reading, says:

> Another element of reading consists in the ability to recognize the meaning of words. This is a more difficult process than simple pronunciation since it involves not only a recognition of the word but also an extension of experience sufficient to provide a meaningful content with which the word may be associated. The word "radio" is not difficult to pronounce, but until the last few years few elementary children were familiar with its meaning because it was not a part of their experience. Since a recognition of the meaning of words demands a breadth of experience which includes the word, it is clear that ultimate maturity in this element will be a difficult point to reach. However, the extension of the pupil's vocabulary to provide for recognition of common words is one of the fundamental requirements of the course in reading.

Vocabulary growth. There are several factors which determine the child's vocabulary, the most important of which are his chronological age, his mental age, and the opportunities his environment presents for language experiences. The interests of those about him and his own interests will largely determine the direction the development of his vocabulary takes although, during the first five or six years of a child's life, the environment for children in general is largely that having to do with home and playmates.

---

[1] Buswell, G. T. "Fundamental Reading Habits: A Study of Their Development," *Supplementary Educational Monographs*, No. 21, pp. 4, 5. 1922. University of Chicago, Department of Education.

Brooks[1] compiled from several sources the material listed in Table XLVIII, showing the spoken vocabularies of children at different ages. He states that these data are not typical in that the children were above the average in ability and in addition came from a superior environment. However, they do show growth in vocabulary and that children may have a rather large spoken vocabulary when they enter school.

TABLE XLVIII. CHILDREN'S VOCABULARIES, AGES THREE TO SIX, DETERMINED BY LISTENING TO THEIR CONVERSATION

AGE	NUMBER OF CHILDREN STUDIED	AVERAGE VOCABULARY *	RANGE OF VOCABULARY
3	14	1,206	642 to 1,809
4	8	1,825	922 to 2,777
5	3	3,326	1,528 to 5,947
6	2	3,103	3,075 to 3,132

* These numbers are net. All proper nouns, and any variations of nouns, verbs, and adjectives (unless from different roots), have been eliminated. These active oral vocabularies are above the average because the children studied were of superior environment and heredity. On the other hand, the active vocabulary is always much smaller than the passive vocabulary — words understood when heard but not actually used by the child. The data are not reliable because too few children have been studied at each age. (Compiled from data in *Pedagogical Seminary*, Vol. 24, pp. 204–243; Vol. 22, pp. 183–203; Vol. 14, pp. 401–438; etc.)

---

[1] Brooks, F. D. *The Applied Psychology of Reading*, p. 61. D. Appleton and Company. 1926.

The child should have a wide spoken vocabulary when he enters school. Since the emphasis in the first three grades is devoted largely to oral reading and since oral reading in the first grade develops out of oral vocabulary, a large part of the teacher's effort must be devoted to enlarging this vocabulary. If the child has a limited supply of words, it is still more important that vocabulary training be emphasized. Many children develop a glibness in using words without at the same time developing meaning. This tendency must be carefully guarded against. The primary child has not reached the stage in language development at which he is able to develop meaning from language itself. However, as he becomes more mature and the range of his experiences widens he is able more and more to secure meaning from word combinations and thus extend his range of experiences.

Developing a meaning vocabulary. In developing a meaning vocabulary the most important factors over which the teacher has control are motivation and experience. At different periods of the child's development, however, different steps are necessary in the process. *The Twenty-Fourth Yearbook of the National Society for the Study of Education* [1] lists the most important steps for each grade. Those for the second and third and for the fourth, fifth, and sixth are quoted here that the reader may see how vocabulary growth is conditioned by the gradual extension of the child's interests and experiences.

---

[1] *Op. cit.*, pp. 91–96.

SECOND AND THIRD GRADES

1. Steps in Extending a Meaning Vocabulary

1. Wide extension of vocabulary through experiences, with care that appropriate new words are learned to fit into experience. Arousing curiosity concerning new words which convey interesting meanings. Special attention to words and idioms significant in beginning number and geography.

2. Growth in expecting words met in context to fit into context and to be words which children themselves use or hear others use.

3. Growing knowledge of when to ask for help in interpreting the meaning of a word met in context.

4. Utilizing knowledge of synonyms in clarifying text difficulties. Children give words or groups of words which mean the same as those in the text. For example, the book uses *a haughty maiden;* the child supplies *a proud girl.*

5. Exercises in classifying words under general headings to call attention to certain elements of meaning; *e.g.*, from a given list of words children arrange two lists, one containing the names of workers, the second containing the name of the work each does.

6. Informal and standard vocabulary tests to make certain that steady growth is being attained.

FOURTH, FIFTH, AND SIXTH GRADES

1. Steps in Extending a Meaning Vocabulary

1. Rapid growth of vocabulary through actual experience and wide reading. Special attention to words and idioms significant in arithmetic, geography, and other

content studies. Arousing interest in new words as suggesting new ideas.

2. Training in expecting words met in context to fit into context and to be words which children themselves use or hear others use. Inculcating good habits in asking for help with words. Gradual use of vocabulary helps and dictionaries introduced. Proper subordination of words to main ideas in context. The dictionary is to be used mainly for pronunciation, seldom for definition.

3. Continued work with synonyms, children asking for synonyms when difficult words are found in context, also giving words or groups of words which mean the same as those in the text; for example, the book uses *in expectation of conquests;* the pupil supplies *ready for victory.*

4. Attention to words and groups of words in context whose value will be increased because of intensive work done with them in composition and grammar. This should involve the application of training and should illuminate the context.

5. Exercises in classification of words as to thought relationships. This work may include lists of synonyms and synonymous expressions, and of words with common roots, prefixes, and suffixes.

6. Testing of vocabulary growth by use of both informal and standard tests.

Perception of words. One of the most important problems connected with the study of words relates to the way in which words are recognized. It was formerly thought that the letters of a word are perceived separately and then combined into wholes. If we notice an object, however, we do not first notice the separate parts and then make a whole of it. On the contrary, the object is first perceived as a whole and then, if further attention is given to it, we pick out various parts and notice their relation to each other. Cattell,[1] by means of extensive studies in the psychological laboratory, discovered that perception does not proceed by letters but by words or large language units. His results were later confirmed by others and we now know that words are perceived as wholes and not by separate parts. The general form of a word is responsible for its recognition. It has been found that the letters in the first part of the word and the upper half of the word are the most important items in word recognition.

Gates[2] has pointed out that a pupil with a small reading vocabulary or one who has recognition difficulties nearly always has trouble with his reading. Gates has also pointed out five causes of difficulties in word recognition: (1) inadequate experience in using spoken language, (2) wrong choice of words for study, (3) no training in word recognition, (4) poor method of perceiving words, and (5) inferior mentality. Four of those difficulties can be overcome by training. The most effective method of teaching recognizes the fact that an accurate and clear perception of the word and a definite knowledge of its meaning are necessary to its mastery. Furthermore, the word should be perceived and its meaning understood in a variety of situations.

---

[1] Cattell, J. M. *Philosophische Studien*, II u. III. 1885, 1886.

[2] Gates, A. I. *The Improvement of Reading*, Chap. VI. By permission of The Macmillan Company, publishers. 1927.

Fluency and span of recognition. It has been known since Javal's[1] study that efficiency in reading is related to movements of the eyes. Workers have from time to time studied the relation of the movement of the eyes to reading.[2] Recently at the University of Chicago, under the leadership of a brilliant group of educational psychologists, extensive experiment has been conducted relating to the general problem of reading and eye-movements. Buswell,[3] by means of photographic methods, studied habits of eye-movements for different degrees of maturity. The relation of fluency and span of recognition to reading is clearly shown by his data. Figure 8 is taken from Buswell's monograph.

An examination of the curves proves that span of recognition and rate of recognition grow in quite different ways. The figure shows that the average duration of the fixation pause in silent reading decreases only to a slight extent after the fourth grade. This probably means that rate of recognition matures very early. In studying the figure it will be seen that development in span of recognition comes early in the school life of the child. By the time he reaches the fifth grade the ability to group units of printed materials is practically developed. The importance of the span of recognition is set forth by Buswell [1] in the following terms:

---

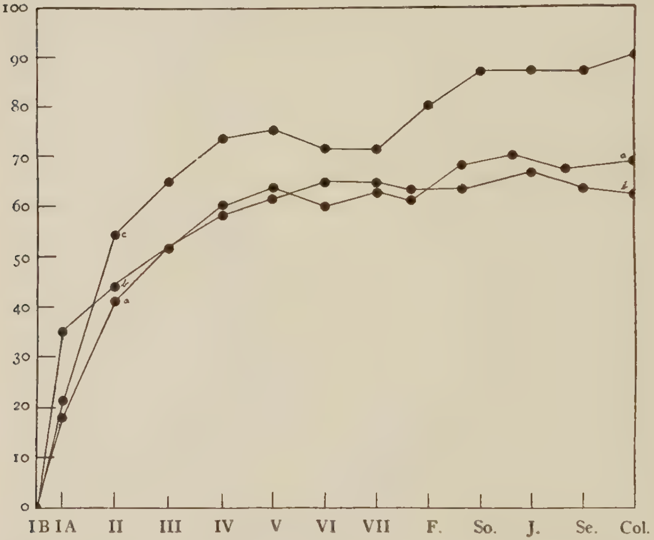
[1] Javal, Emile. "Essai sur la Physiologie de la Lecture," *Annales d'Oculistiques*, Vol. 80, pp. 135–137. 1879.

[2] Huey, E. B. *The Psychology and Pedagogy of Reading*. The Macmillan Company. 1908.

[3] Buswell, G. T. "Fundamental Reading Habits: A Study of Their Development," *Supplementary Educational Monographs*, No. 21, p. 30. University of Chicago Press. June, 1923.

> In the total complex process of reading the size of the average recognition-span is a very significant element. The ultimate goal of reading is to secure meaning from the printed page in large thought units. The smallest possible

FIGURE 8. PER CENT OF INCREASE IN GROWTH FOR THREE EYE-MOVEMENT HABITS — SILENT READING [2]



NOTE. School grade shown on horizontal axis; per cent of increase shown on vertical axis. Curve *a* represents average number of fixations per line; curve *b* average duration of fixation pauses; curve *c* average number of regressive movements per line.

---

[1] *Op. cit.*, p. 30.

[2] Buswell, G. T. "Fundamental Reading Habits: A Study of Their Development," *Supplementary Educational Monographs*, No. 21, p. 56. 1922. University of Chicago, Department of Education.

unit of thought is the word, while the most common units are phrases. As long as a reader is unable to grasp these thought elements in a single recognition his mental processes are interrupted by the necessity of piecing together the material to make up meaningful elements.

In oral reading the eye-voice span or the eye-voice recognition span as it might be called is a factor. As one reads, the eyes glance along the printed line, keeping several words ahead of the voice. As soon as words are recognized the eyes move on to the next fixation point while the words are being pronounced. The distance between the fixation point and the word being spoken is known as the eye-voice span. Little is known concerning training which will develop a wider span. Eye pauses are in themselves probably not the cause of poor reading but only the symptoms of poor habits of recognition of words and phrases and of too little drill under pressure of a time limit. The best type of training is probably given by having pupils read somewhat easy materials under the pressure of a time control.

Anticipation of meaning. Another important element entering into the process known as comprehension in reading is the ability to anticipate what is coming next on the basis of what has just been read. This ability in itself is a complex one and might be analyzed into many simpler ones. It undoubtedly involves, among other things, the ability to assume a mental set or attitude toward what is being read. The building up of such an attitude in turn depends on interest in reading, the ability to read between the lines, and ability to judge from the meaning of a group of words what should follow. Sentence sense and paragraph sense are involved in the ability to anticipate what is to follow. The ability to feel the limitations in meaning placed upon words used in context is an important element. Words do not have the same meaning when used in different contexts. In order to anticipate and be ready for what is to follow, the reader must be able to get the exact meaning of words as they are limited by the context. Meaning is a changing interpretation during the reading process. The skilful reader is able to hold in mind an interpretation as he moves through a paragraph. This interpretation is constantly changing as he reads further and as he anticipates what is ahead. His interpretation is partly determined by what he thinks the writer is leading toward. Gray[1] suggests that three factors aid the student in acquiring the ability to anticipate the meaning of material that is being read: familiarity with the field in which the material being read lies, a language sense, and wide reading.

Interpretation. Students of the problems involved in learning to read have emphasized the fact that comprehension in reading is largely dependent upon the reader's ability to interpret the selection read. Interpretation depends in turn upon a number of simpler processes. Fluency and span of recognition, the ability to anticipate meaning in terms of what has already been read, and the ability to analyze properly the reading situation are all factors in the process of interpretation.

---

[1] Gray, C. T. "The Anticipation of Meaning As a Factor in Reading Ability," *The Elementary School Journal*, Vol. XXIII, pp. 114–126. April, 1923.

Analysis, association, and judgment. Thorndike,[1] in a study of mistakes in paragraph meaning, emphasized the factors mentioned in the heading of this paragraph as important in the reading process. He says that "reading is a very elaborate procedure, involving a weighing of each of many elements in a sentence, their organization in the proper relations one to another, the selection of certain of their connotations and the rejection of others, and the cooperation of many forces to determine final response." The ability to judge the value of materials and the knowledge of the proper use of the mechanics of reference work are closely related to the interpretative process.

Organization. The ability to organize properly materials being read is closely related to comprehension. It is probably one of the abilities entering into comprehension ability and as such should receive the proper emphasis in training. In any program for the improvement of comprehension, it is necessary to lay stress on the development of the abilities of which it is composed. Special training in the ability to organize is probably the best way to improve this aspect of comprehension.

---

[1] Thorndike, E. L. "Reading as Reasoning: A Study of Mistakes in Paragraph Reading," *Journal of Educational Psychology*, Vol. VIII, No. 6, pp. 323–332. June, 1917.

Horn,[1] in discussing exercises for the improvement of this ability, says:

> It seems probable, however, that the best conditions under which such exercises may be developed are to be found in the regular work of the school. If assignments are focalized and detailed, if the student is encouraged to work carefully but at top speed during his study period, and if the recitation is based on the questions put in the assignment, considerable ability to organize will be developed. However, short exercises are necessary in order to put before students standards of the sort of work they are expected to do, and in order to develop proper methods of work.

Many children are poor readers because they do not have the ability to organize the facts which they should get as they read. Great care should be exercised in properly adjusting rate of reading so as not to hasten a pupil to such a degree that time may not be used for, and attention paid to, organization. A short period given to an outline or summary is valuable. Also it is a good thing to have a number of questions which will help the pupils in their organization and teach them to ask themselves questions.

Retention and reproduction. Horn[2] based a constructive program for the development of the ability to remember what is read on these principles: (1) that a single reading ordinarily gives a rather small return, (2) that most of this is forgotten in a short time unless additional work is done, and (3) that there are good methods whereby pupils may learn materials so as to be able to recall them for use in future situations. Experiments quoted by Horn seem to show that, for a single reading, from 20 to 40 per cent of the materials could be reproduced immediately. Other experiments indicate that[1] "until students have learned to summarize efficiently, better results are to be obtained by continued thoughtful rereading, and by summarizing with the aid of questions prepared by the teacher. As in the case of other exercises, the best work in establishing the habit of learning material for future use can probably be done in connection with such subjects as geography, hygiene, nature study, and history. The proper conditions seem to be to read under the guidance of a problem or series of problems; to read directly through the article at fair speed but within the limits of perfect comprehension; to have a set of questions, preferably the set presented in the assignment, which may be used for self-testing and as a basis for summarizing the material."

---

[1] Horn, Ernest. "A Constructive Program in Silent Reading," *Journal of Educational Research*, Vol. III, No. 5, pp. 336–344. May, 1921.

[2] *Op. cit.*, p. 343.

Rate of reading and comprehension. Most of the investigations dealing with rate of reading and comprehension have found positive correlation between the two. This is equivalent to saying that there is a tendency for the rapid reader to surpass the slow in comprehension. The writers have found small positive correlations between rate and comprehension ranging from .26 to .47 for grades III to VIII inclusive. There seems to be closer correlation in the lower grades than in the higher. Good[1] suggests that comprehension may be largely independent of rate in that all three classes of readers — slow, moderate, and fast — will contain some who have good comprehension ability and some who have poor.

---

[1] *Op. cit.*, p. 343.

Rate of reading, like comprehension, is a very complex process depending on mental ability, training, and the materials being read as well as on other factors. Mental ability certainly is a factor entering into both rate and comprehension and it is entirely possible that this factor is partly responsible for a positive correlation between the two abilities. Again, a person who has good training in comprehension will very likely at the same time have received good training in rate and *vice versa*.

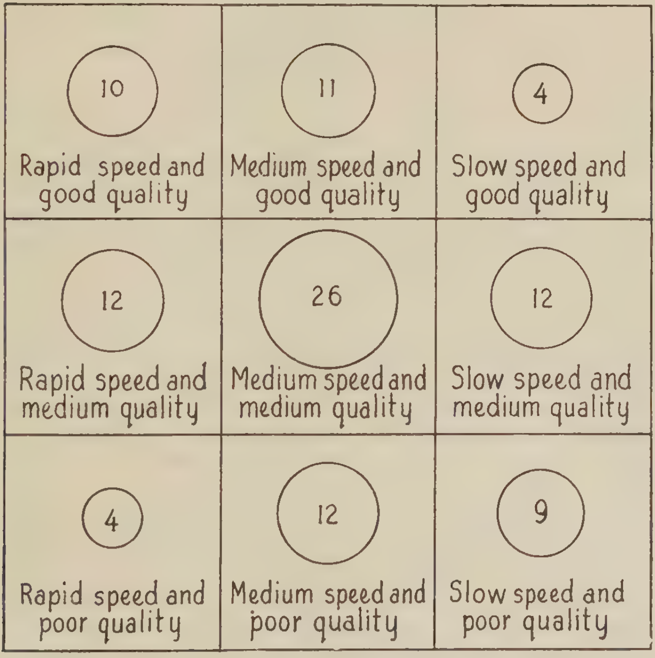
Figure 9 shows the results of a study made by Judd.[2] He divided the records made by a large number of pupils into three groups — rapid, medium, and slow. The groups were composed of 25 per cent, 50 per cent, and 25 per cent respectively. After this division was made the comprehension scores were similarly classified. This made a possible classification of nine groups according to rate and comprehension. Of the rapid readers there were some who had high comprehension scores, some medium, and some low. Those pupils with medium and slow rates of reading were grouped in a like manner according to the comprehension score.

---

[1] Good, C. V. *The Supplementary Reading Assignment*, p. 27. Warwick & York, Inc.

[2] Judd, C. H. *Measuring the Work of the Public Schools*. Chap. VII, p. 115. The Survey Committee of the Cleveland Foundation. 1916.

FIGURE 9. PERCENTAGE OF CLEVELAND PUPILS FOUND IN EACH OF THE NINE SPEED AND COMPREHENSION GROUPS IN SILENT READING[1]



10 Rapid speed and good quality	11 Medium speed and good quality	4 Slow speed and good quality
12 Rapid speed and medium quality	26 Medium speed and medium quality	12 Slow speed and medium quality
4 Rapid speed and poor quality	12 Medium speed and poor quality	9 Slow speed and poor quality

Interest and motivation. In any program of reading, one of the primary objects is to develop motives for and interests in reading that will influence the life of the reader long after he has left school. *The Twenty Fourth Yearbook of the National Society for the Study of Education* states:

---

[1] Judd, C. H. *Measuring the Work of the Public Schools*, p. 115. The Survey Committee of the Cleveland Foundation. 1916.

> The ultimate measure of the vitality of the reading experiences in school is the extent to which they lead to desirable interests, standards, tastes, and habits which carry over into life outside of school, such as interest in current events, in books and selections of genuine worth, and in the wholesome use of leisure time. The accomplishment of this aim makes it necessary to acquaint pupils with the sources and values of reading materials of both the work and recreational types, and to develop standards which may be used in selecting reading materials.
>
> The importance of stimulating strong motives for reading is emphasized by the fact that thousands who learned to read in school read very little, if at all, as adults. Furthermore, a surprisingly large number of people state frankly that they are not interested in reading or that they do not know where to secure materials which they might care to read. If school systems are justified in spending millions of dollars each year in teaching pupils to read, it is imperative that permanent habits of reading be established in order to secure intelligent participation in personal and social activities for which society makes such generous provision. In this connection, special attention should be given to those pupils who learn slowly, who encounter unusual difficulties, or who fail to respond to the motives that appeal to most pupils.[1]

---

[1] *The Twenty-Fourth Yearbook of the National Society for the Study of Education*, Part I, p. 11. Public School Publishing Company. Also see Donovan, H. L. "Minimum Essentials in Education." *Peabody Journal of Education*, Vol. II. January, 1925.

In attempting to motivate reading and build permanent interests, it must be remembered that these are acquired according to the laws of learning just as other school habits are. If a child has no interest in reading, the first task facing the teacher is to build up interests before attempting to develop the mechanics of reading. An important item for the teacher to know is that interests grow out of interests and do not blossom forth in a spontaneous manner. Accordingly, all reading motives must be based on the present interests and needs of the child. "Too often we set up artificial motives to inspire children to work diligently on subject matter prescribed by the traditional curriculum. A much saner policy would be to study the children and look for subject matter which will enable them to realize the purposes and plans they themselves originate." [1]

All interests grow out of the experiences of the child. It is necessary for the teacher to know something of these and to create situations which call for responses related to the experiences. Sometimes children from poor environments have little background for reading experiences. In this case the teacher must build up interests before reading is taught.

Teaching methods to a large extent determine the interest or lack of interest of pupils. Definite assignments, with definite methods of checking on achievement, and proper methods of making known the results of tests are conducive to an interest in the work. Pupils who are unable to do work assigned should be given special work which will make improvement possible. Children who are not interested in one type of material and show lack of improvement frequently make steady gains in reading a different type of material. After such pupils become conscious of and interested in their improvement, this factor may be carried over to less interesting material but material which should be mastered. It is better, if possible, to carry over to uninteresting materials interests which have been developed in other fields and thus motivate reading than it is to drag in extrinsic factors for that purpose. However, extrinsic factors may be used without detriment if the teacher is able to handle these in such a manner that they do not become a definite part of the reading situation for the future.

---

[1] Harris, Julia M., Donovan, H. L., and Alexander, Thomas. *Supervision and Teaching of Reading*, p. 347. Johnson Publishing Company. 1927.

Interest and motivation must not be thought of as desirable in order to make reading easy for the pupil. The fact is, however, that when work is properly motivated and based on the interests of the pupils, it appears easier to them. Since work under such conditions is much more pleasant, the pupils will do an enormous amount of it and secure better learning experiences while doing it.

Attention and mental set and comprehension. The facts discussed under interest and motivation are closely related to the topic treated here. There are two aspects of the topic under consideration.

In the first place the development of proper attitudes toward reading is absolutely essential to the teaching of reading. The attitude or set a pupil takes regarding the work of the school will to a large extent determine his achievement. Peterson,[1] in an experiment which shows the effect of attitude on recall, found that when a list of words was given to students with no mention of the fact that they would later be required to reproduce the words, the pupils did much poorer than when warned beforehand that reproduction would be required. The experiment showed that when the group knew reproduction would be required, they did 14.8 per cent better in immediate reproduction and 48.4 per cent in delayed reproduction. The experiment seems to indicate that when a certain attitude was taken by the group, superior results were achieved.

Numerous studies have been made to determine the effect of different attitudes on reading results. Table XLIX, taken from the results of Judd and Buswell,[2] indicates the effect produced by giving directions which induce different attitudes in pupils. It also shows that, when different attitudes are set up by different directions or purposes, the same subject exhibits marked differences in his reading behavior.

Other factors affecting comprehension in reading. In addition to the factors already mentioned, which are largely a result of training, there are others which have to do with poor ability in reading: poor eyesight, poor hearing, and other physical disabilities. Sometimes there appears to be some form of special disability, as poor visual memory or poor auditory memory, in a child who seems to possess good general ability. These special disabilities are treated more fully in a later paragraph dealing with diagnosis.

---

[1] Peterson, J. "The Effect of Attitude on Immediate and Delayed Reproduction: A Class Experiment," *Journal of Educational Psychology*, Vol. VII, pp. 523–532. 1916.

[2] Judd, C. H., and Buswell, G. T. *Op. cit.*, p. 54.

Table XLIX. Record of Subject A23 in Various Types of Reading and Analysis

Types of Reading and Analysis	Average Number of Fixations per Line	Average Duration of Fixation Pauses
1. Simple oral	14.1	5.4
2. Silent — questions	11.8	5.0
3. Peculiar words	12.8	6.3
4. Emphatic oral	12.0	6.8
5. Silent — dictate ideas . .	11.4	5.2
6. Paraphrases	48.0	9.0
7. Verbs	12.2	6.0
8. Silent — Verbatim	12.0	5.3

FACTORS IN THE DEVELOPMENT OF RATE IN READING

Development of rate in reading. Rate in reading is measured in general by the number of words read per minute by a pupil. It is evident that the nature of the material and the purpose for which a child reads will partly determine his rate. One might therefore more accurately speak of the rates of reading of a pupil. Not only is it true that a pupil will read different materials at different rates and that his purpose in reading will influence his rate, but his rate in silent reading will very likely be several times as rapid as his rate in oral.

This latter fact is one of the most important discoveries made by educational psychologists. Simple time measurements show that reading is several times as rapid when done silently as when done orally. This simple laboratory discovery has led to a great shifting of emphasis from oral to silent reading in the school.

Norms for reading rate are secured by taking the median rate per minute when the same material is read by a large number of children. Different norms are established by different research workers. These differences are largely due to the fact that different reading materials were used in securing the norms. Table L gives the rate norms published for certain well-known reading tests.

TABLE L. RATE NORMS FOR CERTAIN SILENT READING TESTS

TEST	GRADE	II	III	IV	V	VI	VII	VIII
Courtis		84	113	145	168	191		
Gray		90	138	180	204	216	228	240
Monroe (Form 1)			82	122	142	158	170	183
Starch		108	126	144	168	192	216	204

The development of reading will, in the main, show one of two characteristics, depending on the type of material read and the purpose of the reader.

In one case there appears to be a rather gradual improvement in rate over a large number of years. This is probably true when the individual reads chiefly one type of material of approximately the same degree of difficulty and chiefly for recreational purposes. Where the purpose of the reader is to get the content and the material increases in difficulty as the reader advances in the field, his rate of reading is more constant.

Skills influencing rate of reading. In addition to certain mechanical factors — such as size of type, arrangement of the material on the page — and the factor of intelligence, there are a number of skills which enter into the more complex one known as rate of reading. O'Brien[1] lists the following factors in the development of speed in silent reading:

1. Practice in rapid reading.
2. The decrease of vocalization.
3. Training in perception.
4. Familiarity with subject matter.
5. Habits of eye-movements.
6. Purpose for which subject matter is read.
7. Concentration of attention.
8. Ability to grasp the meaning of content.
9. Recognition of the value of rapid reading.
10. The pressure of a time-control.
11. Individual graph and class chart.
12. Other factors, size of type, etc.

---

[1] O'Brien, J. A. *The Twentieth Yearbook of the National Society for the Study of Education*, Part II, Chap. IV. Public School Publishing Company, Bloomington, Ill. See also O'Brien, J. A. *Reading, Its Psychology and Pedagogy*, pp. 249 ff. The Century Co. 1926.

There is some overlapping in the list as given by O'Brien and several are concerned with devices for motivation. The psychological factors entering into speed in reading may very well be listed as those having to do with:

1. Motor coördinations.
2. Fluent and accurate perceptions.
3. Attitude and mental set.
4. Interest and motivation.
5. Other psychological processes entering into comprehension.

There is a certain amount of overlapping in this list. It must be remembered that the reactions of an individual are to be considered ultimately as a unit rather than a number of discrete processes. In a reading situation the individual functions as a whole and not in a piecemeal manner. We may analyze certain aspects of the reaction and thus discuss perception, attitude, and the like. When this is done, we must understand that it is done for convenience only or for the purpose of emphasizing certain of the more elementary processes which enter into the whole. We may create reading situations which emphasize certain types of reaction and thus drill for particular skills. The fact that reading, either oral or silent, is such a complex reaction makes it necessary to emphasize different aspects at different times in order that they may be developed in such a way as to function properly.

Motor coördinations and reading rate. Reading rate undoubtedly depends in a large measure on the ability of the child to unify properly the movements of the speech organs and the eyes. The development of this ability is discussed in the two following paragraphs:

a. The speech organs. In studying the motor phases of reading those dealing with movement of the eyes and organs of speech are especially important. The movements involved in reading have their origin and much of their growth early in life. From the poorly controlled movements involved when the child begins forming his speech habits, all later finely coördinated movements in oral reading develop. The child comes to school with oral speech habits fairly well fixed. Skill in oral reading involves the association of printed words with spoken and with the things for which the spoken words stand. The motor coördinations used in speaking function in the oral reading developed in the primary grades. A fine coördination of the speech organs is essential for both oral and silent reading. The difference between the two is that these coördinations are used and emphasized in oral reading while in silent reading the coördinations are essential but the movements made by the speech organs are minimized. Gross movements by the speech organs retard silent reading and it is essential that training be given to decrease these. Thus, training to decrease vocalization is an important item in developing rate in silent reading. The object of this training is not to destroy the coördinations built up among organs of speech but to reduce the movements of the organs thus coördinated. It has been found by a number of workers that such training results in an increase in the rate of silent reading. It is doubtful whether inner speech — small movements of the speech organs — is ever entirely eliminated in silent reading. From what we know concerning the nature of the reactions of an individual one would think that this could not be done. Thinking, silent reading, and studying are but different aspects of activity involving to a very large extent the speech organs. Efficiency in these is secured in part by reducing vocalization.

b. Eye-movements. Among the motor phases of the reading process none have received so much attention in the psychological laboratory as those pertaining to eye-movements. Javal (1879), at the University of Paris, seems to have been the first investigator to discover that in reading the eye does not move in one continuous movement along the line but that its passage is characterized by pauses and rather short but rapid movement. Various individuals aided in the perfection of a technique for measuring the duration of the pauses and their number. Dodge developed a method of photographing a beam of light as reflected from the eye. Other individuals, notably at the University of Chicago, have utilized and developed Dodge's method. By the utilizing of an electrically driven timing device in connection with his photographic records Buswell was able, as the pupil read, to intercept fifty times per second the beam of light which he was photographing. Thus he secured a record from which he could find the time consumed in fixation pauses, inter-fixation movements, and regressive movements, as well as in the sweep from the end of one line to the beginning of the next. The accuracy of the return sweep, as well as the number of regressive movements necessary, could also be determined from the record. Table LI shows growth in the fundamental habits pertaining to eye-movements.[1] It will be seen that there is rather rapid growth during the first few grades in all three eye-movement habits.

TABLE LI. PERCENTAGE OF INCREASE IN GROWTH OF THREE EYE-MOVEMENT HABITS — SILENT READING

EYE-MOVEMENT HABIT	SCHOOL GRADE												
	IB	IA	II	III	IV	V	VI	VII	F	So	J	Se	Col
Average number fixations per line	0	17	42	52	60	63	60	63	61	69	70	66	68
Average duration of fixation . .	0	35	45	52	59	62	65	64	63	63	66	63	62
Average number regressive movements .	0	22	55	65	73	75	71	71	80	86	86	86	90

A study of eye-movements is valuable because these movements portray comprehension conditions. Poor habits of eye-movement in reading are probably a result of the same type of training or lack of training as that which accounts for poor ability in the various phases of comprehension. Lack of ability to organize material and to anticipate meaning, and lack of other abilities involved in thought getting are in all probability highly correlated with a lack of proper motor habits. These motor habits must not be conceived of as something developing apart from psychological processes. They are intricately connected with training in interpretation, perception, and the like. This means that the same type of training needed to develop proper motor habits in reading also develops good mental habits.

---

[1] Buswell, G. T. *Op. cit.*, p. 55.

Fluency and accuracy of perceptions and rate of reading. A large amount of experimental work has been done on the span of perception in both oral and silent reading. It has been found that some individuals recognize a given unit more quickly than others. Rate of perception, as measured by the duration of pauses; span of perception, as measured by the distance between pauses; and accuracy of perception, as measured by regressive movements — all enter into rate of reading. The part each plays, however, is largely determined by comprehension factors. The difficulty of the passage being read, word knowledge, familiarity of materials, size of type, purpose of reading, and other factors determine the fluency and accuracy of eye-movements.

Attitude and mental set and rate of reading. The purpose for which material is being read, either orally or silently, will determine to a large degree the rate of reading. If one reads for the purpose of answering questions, he assumes quite a different attitude from that assumed when he reads a short story with no problem in mind. The method of attack and the entire mental set assumed will be determined largely by the purpose in view. C. T. Gray[1] made photographs of eye-movements when materials were being read for different purposes. His results showed clearly that reading for different purposes results in differences in rate.

TABLE LII. C. T. GRAY'S EYE-MOVEMENT RECORD OF ONE SUBJECT SHOWING VARIATIONS ACCORDING TO PURPOSE FOR WHICH THE MATTER WAS READ[2]

AVERAGE	PROSE (Simply to Understand)	PROSE (Answering Questions)	POETRY (Answering Questions)	PROSE (Reproduction)
No. of Pauses per Line . . .	8.1	9.6	11.0	8.7
Length of Pauses	13.3	13.9	14.0	14.6
No. of Regressive Movements	1.8	2.4	3.3	1.8

NOTE. The table is to be read as follows: The average number of fixation pauses per line in reading prose (simply to understand) is 8.1.

There are many purposes for which persons read. Teachers have in the past made the mistake of not having pupils read materials for different purposes.

---

[1] Gray, C. T. "Types of Reading Ability as Exhibited through Tests and Laboratory Experiments," *Supplementary Educational Monographs*, No. 5. 1917.

[2] Adapted from O'Brien, J. A. *Silent Reading*, p. 61. 1921. Used by permission of The Macmillan Company and University of Chicago, Department of Education.

Each purpose should have special emphasis and the work of the reading period should be so arranged that pupils in the grade get training at some time in all forms of reading. This especially applies to silent reading, but the problem is also important in the primary grades, where often the emphasis is largely on oral reading.

Because attitude and mental set determine to a large extent achievement in comprehension and rate in reading, these two factors deserve special consideration in the upper grades where departmental teaching is often done. In these grades reading is too frequently considered only in relation to literature. Generally, teachers of the other subjects are not acquainted with the scientific findings in fields outside their own. They assume that because pupils make a good score on an intelligence test or on a standardized reading test they should do successful work in some particular subject. Often this is not the case. Pupils frequently fail in the school subjects because they have not learned how to read the materials. Studies have shown that there are certain words peculiar to each school subject. A large number of new hard words will decidedly influence the pupil's attitude toward that subject unfavorably. By aiding him in word study the teacher may be of help in creating a favorable attitude.

Interest and motivation and reading rate. Interest is not a mysterious force possessed by some individuals and not by others. Most persons are interested in something. The trouble with many school children lies in their having developed only a few interests upon which the work of the school can be based. If children do not, when they come to school, possess interesting experiences upon which reading may be based, it is necessary that such experiences be given. Sometimes, because of poor teaching methods, pupils reach the upper grades with a distaste for reading. The teacher cannot sit idly by and wait for this condition to pass. Factors making for lack of interest must be removed and situations possessing qualities that do interest must be substituted. Removal of the cause of lack of interest is frequently one of the best ways of motivating school work. Interest is a result of learning. By manipulating school situations in the light of the conditions of the learner, interest may be developed just as any habit of thought or skill is developed.

Gates[1] notes the following methods of motivating remedial instruction in reading, and since they apply equally well to rate in reading they are listed here.

1. Make improvement possible.
2. Adjust material to pupil's ability.
3. Select attractive content and exercises.
4. Measure and display improvement.
5. Enlist the competitive impulse.
6. Detect the pupil's particular errors and successes.
7. Choose time and method of beginning remedial work.

---

[1] Gates, A. I. *The Improvement of Reading*, pp. 31–36. 1927. By permission of the Macmillan Company, publishers.

8. Be optimistic and encouraging.
9. Distribute practice so as to avoid fatigue and boredom.
10. Provide a variety of materials and exercises.

Other factors influencing rate in reading. There are other factors which affect rate in reading. The mechanical make-up of the printed page, including the size of the type, the amount of material on the page, the kind of paper used, and the various other things which give cues — thus making it possible for the reader to size up the reading situation — all influence reading rate. Intelligence also is an important factor in reading rate. The writers have found coefficients of correlation ranging from .34 to .74 between rate and intelligence, when rate was measured by the Monroe Silent Reading Test and intelligence was measured by the National Intelligence Test. At present we do not know how all the various factors which are developed by training and which make a rapid reading rate possible correlate with intelligence.

QUESTIONS AND EXERCISES

1. Why does oral reading not play so important a part in modern life as formerly?

2. Plot graphs showing growth in reading habits as determined by decrease in number of fixations per line as shown in Table XLVII.

3. How does the primary purpose in silent reading differ from that in oral reading?

4. Amplify the statement "thought is brought to the printed page by the reader."

5. Visit a first-grade class and note any effort made to prepare the children for reading.

6. If possible, observe during several days a child just learning to talk. Note any increase found in vocabulary.

7. What is meant by the term "fixation pause"? "Regressive movements"? "Span of recognition"? "Rate of recognition"? "Eye-voice span"?

8. Illustrate the meaning of "mental set."

9. List all methods you have known teachers to use in motivating reading. Rank these in order of desirability.

10. How does the problem of motivation in the first grade differ from that in the sixth? List the methods of motivation used by the teachers in the classes in reading which you have observed in the elementary grades. Which methods do you consider superior? Are the same methods used in motivating the work in both rate and comprehension?

11. Illustrate the importance of the teacher in motivation. Illustrate the importance of the social situation in motivation.

12. List all the factors which you think influence comprehension.

13. Look up a reference dealing with scientific studies of reading and list the six persons you think have contributed most to our knowledge of the reading process. (Gray, W. S., "Summary of Investigations Relating to Reading," is a good reference.)

14. List all the factors which you think are important in influencing the rate of reading.

15. Secure rate and comprehension scores for reading and study the relation between them. Do the rapid

readers have the highest comprehension scores? Do you find wide differences in ability within the grade?

SELECTED REFERENCES

1. Brooks, F. D. *The Applied Psychology of Reading*, Chaps. VI and VII. D. Appleton and Company. 1926.
2. Buswell, G. T. "Fundamental Reading Habits: A Study of Their Development," *Supplementary Educational Monographs*, No. 21. June, 1922.
3. Cameron, E. H. *Educational Psychology*, Chap. XIV. The Century Co. 1927.
4. Edwards, A. S. *The Psychology of Elementary Education*, Chap. XIII. Houghton Mifflin Company. 1925.
5. Freeman, F. N. *The Psychology of the Common Branches*, Chap. IV. Houghton Mifflin Company. 1916.
6. Gates, A. I. *The Improvement of Reading*, Part II. The Macmillan Company. 1927.
7. Good, Carter V. *The Supplementary Reading Assignment*, Chaps. I, II, III, and IV. Warwick & York, Inc. 1927.
8. Gray, C. T. "The Anticipation of Meaning as a Factor in Reading Ability," *The Elementary School Journal*, Vol. XXIII, pp. 114–126. April, 1923.
9. Gray, C. T. "Types of Reading Ability as Exhibited through Tests and Laboratory Experiments," *Supplementary Educational Monographs*, No. 5. 1917.
10. Gray, W. S. "Summary of Investigations Relating to Reading," *Supplementary Educational Monographs*, No. 28. June, 1925.

11. HARRIS, JULIA M., DONOVAN, H. L., and ALEXANDER, THOMAS. *Supervision and Teaching of Reading*, Chap. XI. Johnson Publishing Company. 1927.
12. HORN, ERNEST. "A Constructive Program in Silent Reading," *Journal of Educational Research*, Vol. III, pp. 336–344. May, 1921.
13. HUEY, E. B. *The Psychology and Pedagogy of Reading*, Chaps. I, V, and VII. The Macmillan Company. 1922.
14. O'BRIEN, J. A. *Reading: Its Psychology and Pedagogy*, Chaps. X and XI. The Century Co. 1926.
15. REED, H. B. *Psychology of Elementary School Subjects*, Chaps. III to VIII. Ginn and Company. 1927.
16. STARCH, DANIEL. *Educational Psychology*, Chap. XVI. The Macmillan Company. 1927.
17. *The Twenty-Fourth Yearbook of the National Society for the Study of Education*, Part I. 1925.

CHAPTER XV

MEASUREMENT IN READING

The measurement movement in education has long since passed the trial stage. Only those who hold that teaching must always remain a hit or miss affair or those who have some pet theories which they are afraid to submit to searching scientific scrutiny continue to oppose the movement. There are perhaps a few others who by habit are opposed to any new ideas concerning teaching because a new idea interferes with their complacent adjustment to life and any attempt to arouse them from their lethargy is resented.

Reading tests are by no means perfect and their makers would be the last to claim perfection for them. Overzealous and untrained individuals have been responsible for most of the misuses made of tests. We have reached the point in the progress of teaching where we do not ask whether objective studies of reading shall be made but whether the best tools and methods of work are available for making them. We must continue to make use of the best materials available until better are devised. By taking a constructively critical attitude we may eventually discover just what specific habits enter into the various reading responses and how these may best be measured. Even after these discoveries are made, there will still remain the difficult problem of interpretation. Too often, at present, persons who have had no training are attempting to interpret results of measurements of an intricate psychological nature. There is little wonder that the results of measurement are of small value, for their values are determined in a large measure by the ability and training of the person who attempts to interpret them and outline a reading program according to their implications.

In this book the purpose of the discussions dealing with individual differences and measurements is to acquaint the student with the field. Those who desire to make use of the work of the psychologist should take additional training in child and educational psychology as well as in tests and measurements.

Types of tests. Two types of tests may be used in the teaching of reading: informal tests, devised by the teacher for some specific purpose, and standardized tests. Both types are of value. The type used should depend upon the purpose which the teacher has in mind. Since standardized tests have been developed in most instances for the purpose of measuring progress in rate or comprehension, or in both, they cannot be used so well as informal tests for the study of some specific factor in reading.

Informal tests. Informal tests differ from standardized in that they are constructed by the teacher for the purpose of studying the effect of the use of certain materials or to determine whether pupils possess specific abilities which are necessary for skill in reading. Informal tests are especially useful in diagnosing pupil difficulties. Standardized tests have definite norms which have been secured by giving the tests to many children.

Uses of standardized tests. Standardized tests are used primarily for three purposes: (1) survey, (2) diagnostic, and (3) instructional.

When it is desired to compare children in one school system with those in another in regard to reading ability or children in one section of a grade with those of another of the same grade in one building or in different buildings in the same system, standardized tests are used. Thus, if a county supervisor desires to compare the pupils in one school with those in another, she should use standardized tests. If she wishes to compare the efficiency of one-room schools with the efficiency of larger, standardized tests furnish the best means of securing a comparison.

Until recently, standardized tests furnished about the only way of making accurate diagnosis. With the spread of information concerning methods of constructing objective tests informal ones have become equally important. Several of the more widely used tests are of great value in locating pupil difficulties. The Gray Oral Reading Test, the Monroe Standardized Silent Reading Test, the Thorndike-McCall Reading Scale, the Gates Reading Tests, and the reading tests in the Stanford Achievement Test are of especial value. Since the question of diagnosis will be treated at some length in a later paragraph, no further discussion will be given here. The instructional value of tests is as follows: they may be used (1) for the purpose of motivation and

(2) to measure reading progress. When they are used in this way, it is best to have a definite testing schedule for the whole school supplemented by additional testing by the teachers. Tests may, of course, be given at any time during the year. The writers have found that, in a testing schedule for a school system, tests should be administered three times during the year. When this number of measurements is taken, probably the first, the middle, and the end of the year are the most appropriate times for taking them. A test at the beginning of the year furnishes data concerning all the pupils entering the school system for the first time and gives the teacher an idea of their preparation for the work of the grade. Furthermore, if test records are kept from year to year, the teacher will know which pupils have gained or lost during the summer months. This is important in that it frequently shows the teacher whether the children are living in a favorable or unfavorable reading environment. Tests made at the middle and the end of the year indicate the progress made during definite intervals. They aid the teacher in taking an inventory of the results of teaching. If kept over a period of time, the results of standardized tests present a permanent record of the pupil's reading growth. In planning a testing program of the nature discussed here, it is necessary to select a test which has a number of equivalent forms available. For purposes of measuring comprehension, the Thorndike-McCall, which has ten forms, is one of the best.

Table LIII shows the records of a number of pupils who were given the Monroe Standardized Silent Reading Test during the month of February for a number of succeeding years. The records are in terms of per cent of norm.

TABLE LIII. SHOWING THE RECORDS MADE BY TEN CHILDREN ON THE MONROE SILENT READING TEST WHEN TESTED AT INTERVALS OF ONE YEAR *

PUPIL	I.Q. STANFORD BINET-SIMON	3RD	4TH	5TH	6TH	7TH	8TH
A	113	111	120	126	142	121	146
B	138	133	139	142	140	133	131
C	121	129	100	102	94	132	140
D	90	79	92	85	81	92	81
E	84	100	109	97	88	94	92
F	128	107	121	106	110	99	92
G	108	116	124	105	108	114	125
H	82	79	85	88	87	83	82
I	88	96	104	94	94	91	93
J	100	88	104	109	101	100	95

* The scores in the table were secured by dividing each pupil's score at any testing by the norm for that grade. This was done so that the work from grade to grade might be more readily compared. A score of 100 in the table would represent achievement equal to the norm.

An examination of Table LIII will reveal several interesting situations. For example, Pupil C, with an I.Q. of 121, in the third grade reads well according to the test score. In the two succeeding grades he barely makes scores equal to the norms of those grades, while in the sixth grade he is considerably below norm. In the next two years he scores far above the norm. Pupil F appears not to have done the quality of work which might have been expected. It will be noticed that some pupils are fairly constant in their achievement from year to year while others are very irregular. The table shows the importance of keeping objective records of pupils from year to year.

TABLE LIV. SHOWING GRADE SCORES BEFORE AND AFTER SUMMER VACATION (STANFORD ACHIEVEMENT TEST)

PUPIL	AGES IN JUNE			AGES IN SEPTEMBER		
	Test			Test		
	1 *	2	3	1	2	3
1	10.	8.9	6.6	8.5	6.6	6.7
2	8.1	9.	6.7	6.8	7.6	6.1
3	6.2	7.3	6.3	6.3	7.1	6.6
4	8.5	7.2	5.7	8.	8.	7.4
5	6.4	4.9	4.6	6.7	5.4	5.3
6	8.8	4.8	5.4	5.8	4.9	6.2
7	6.2	6.	5.9	5.8	5.5	5.2
8	7.5	7.5	6.6	8.2	8.2	7.5
9	6.2	5.0	5.8	6.	4.7	5.1
10	6.	4.4	5.3	5.2	4.1	4.7

* Test 1, paragraph meaning; Test 2, sentence meaning; Test 3, word meaning.

In Table LIV are shown grade scores for ten pupils before and after summer vacation. In general, it will be noticed that these pupils lost during the summer vacation. There are exceptions to this, however. Notice that Pupil 5 gained in all three phases of reading ability. This pupil came back to school in better condition, so far as reading is concerned, after a vacation of three months. There is some reason for this improvement. A knowledge of the factors making for loss or gain during vacation is of value.

A knowledge on the part of the pupils that records of their progress are being kept secures their interest in improvement. Records from standardized tests when presented to children in the proper way stimulate them to improvement and show definitely whether they have improved. A number of devices may be used in presenting scores to pupils. The writers have used the type of chart shown in Figure 6, page 152. The advantage of using it is that pupils are able to interpret their standing in the class and their standing with respect to grade norms.

The classification of pupils by means of standardized reading tests. Thanks to the laboratory experiments of the psychologist, teaching is fast becoming one of the technical professions. It is now recognized that children with like abilities can most profitably be taught together. Since ability in reading is highly correlated with achievement in the content subjects, it follows that, not only for purposes of reading instruction but for instruction in the other subjects as well, it is desirable in classifying pupils to consider ability in reading. In the classification of pupils no one knows just what weight should be given to measurements of intelligence and measurements of achievement in reading. If measurements are available, probably both should be considered in the classification, depending on the purpose for which it is made. Table LV shows mean reading scores by quartiles for the several grades in a small school where the pupils were poorly classified.

TABLE LV. SHOWING MEAN SCORES MADE BY EACH QUARTILE GROUP WHEN SEVERAL GRADES WERE DIVIDED ON THE BASIS OF MENTAL ABILITY (STANFORD-BINET) AND GIVEN THE KANSAS SILENT READING TEST (Q1 IS THE BEST FOURTH)[1]

GRADE	Q1	Q2	Q3	Q4
VII . . .	28.3	23.8	15.7	14.2
VI . . .	21.7	19.2	18.	15.9
V . . .	23.3	19.	19.	12.8
IV . . .	17.5	14.	10.1	9.8

The table reveals an interesting situation. The better half of each grade is in three cases superior to the poorer half of the grade above. In most cases a higher quartile in a lower grade surpasses the next lower quartile in the grade immediately above. As far as these reading scores are reliable the pupils in the fourth quartile would be better classified if placed in one group than if left in the grades in which they now are. The table shows that when a grade is divided on the basis of intelligence, the reading scores of the poorer groups are similar to scores made by pupils in lower grades and indicates that they may be classified accordingly.

---

[1] Garrison, S. C. "Variation within the Grades," George Peabody College, *Contributions to Education*, No. 8, p. 20. 1922.

Provisions for individual differences. The recognition of the differences existing between pupils of the same age and grade is a result of the trend of modern psychology to attack the problems of the school and to apply its findings to schoolroom procedure. That pupils of the same age and grade may differ enormously is now universally recognized and one of the major tasks of the modern teacher is to find means for making provision for differences in reading ability. The causes for differences in reading ability may be attributed to: (1) differences in general mental ability, (2) differences due to training, (3) differences due to some special defect, as poor vision. Theisen[1] studied by means of a questionnaire the provisions made for individual differences in a large number of school systems. His findings are listed in Table LVI. His material shows that teachers are using many means of meeting the problems presented by the pupils' wide differences in reading ability. Many of the methods employed will probably be discarded in the light of the psychological research made by Gray, Gates, and others as a more definite technique is developed.

The first step to take in making provision for individual differences is to examine the classification of pupils. Frequently by reclassification many of the large inequalities found in the grades may be removed. In case there are several sections of the

---

[1] Theisen, W. W. "Provisions for Individual Differences in Teaching Reading," *Journal of Educational Research*, Vol. II, pp. 260–271. 1920.

TABLE LVI. PROVISIONS FOR INDIVIDUAL DIFFERENCES IN THE TEACHING OF READING

PROVISIONS	PER CENT REPORTING THE USE OF EACH PROVISION				
	Primary	Intermediate	Grammar	Supervisors	All
(A) *Testing of individual abilities*					
1. Tests of rate and comprehension . . .	6	32	29	46	24
2. Intelligence tests . .	6	0	0	0	3
(B) *Grouping of pupils*					
1. Pupils arranged in small groups by ability	56	39	14	54	45
2. Pupils in small groups *not* by ability . . .	3	7	14	8	6
(C) *Gradation of materials read*					
1. Graded to fit individual ability . . .	42	32	7	46	34
2. Selected by pupil's own choosing . .	10	20	21	23	16
3. Portions in oral reading or dramatization assigned according to individual ability	8	7	14	15	9
(D) *Variations in amount of reading practice*					
1. Voluntary reading in free periods . . .	40	22	21	23	29
2. Home reading . . .	27	44	29	23	32
3. Additional periods . .	15	5	7	23	11

NOTE. Percentages are computed on the basis of returns from 118 teachers and supervisors distributed as follows: Primary, grades I and II, 48; intermediate, grades III, IV, and V, 41; grammar grades, VI, VII, VIII, 14; supervisors, 13, ungraded, 5; not specified, 1. Geographically they represent 13 states.

TABLE LVI. PROVISIONS FOR INDIVIDUAL DIFFERENCES IN THE TEACHING OF READING (*Continued*)

PROVISIONS	PER CENT REPORTING THE USE OF EACH PROVISION				
	Primary	Intermediate	Grammar	Supervisors	All
(D) *Variations in amount of reading practice* (Cont'd)					
4. Poorer called on more frequently in oral recitation	0	0	7	8	3
5. Rapid cover more in silent reading . .	4	7	7	0	5
(E) *Personal attention to individuals*					
1. Special help for specific defects . . .	46	44	43	46	44
2. Use of better pupils to help poorer . . .	38	20	14	23	26
3. Home help	4	2	21	0	5
(F) *Adaptation to and development of individual interests*					
1. Materials chosen for individual interests	8	22	29	31	18
2. Individual choice of parts	4	2	7	8	4
3. Best read for inspiration to poorer . .	2	5	0	0	3
(G) *Specific forms and phases of instruction*					
1. Centering attention upon thought					
a. Silent reading . .	65	83	71	77	65
b. Use of thought questions . . .	27	51	43	15	36
c. Illustrate material read by drawings	6	7	0	0	5
d. Thought drills . .	3	27	21	8	14

TABLE LVI. PROVISIONS FOR INDIVIDUAL DIFFERENCES IN THE TEACHING OF READING (*Continued*)

PROVISIONS	PER CENT REPORTING THE USE OF EACH PROVISION				
	Primary	Intermediate	Grammar	Supervisors	All
(G) *Specific forms and phases of instruction* (Cont'd)					
2. Problem assignment	4	2	0	8	3
3. Motivation	54	54	36	23	48
4. Dramatization for certain pupils not included under C–3	3	10	7	15	7
5. Word and phonic drills	35	39	29	54	41
6. Phrase drills	19	29	7	31	23
7. Speed drills	0	17	29	23	14

same grade taught by different teachers a thorough study of the ability of the pupils and an accurate reclassification will obviate the necessity for provision being made by a teacher for the children of widely different degrees of reading abilities as children of like abilities may be classified together. However, this does not eliminate the great range of interests and environmental influences.

The individual teacher may make further divisions of her group after the children in the school as a whole have been reclassified. This will still further simplify the problem of provision for differences. Usually, the pupils in a grade may be classified into about three groups: (1) those who have a high reading rate and poor comprehension; (2) those who have good comprehension ability but a poor reading rate; and (3) those who are poor in both. In all these groups there will frequently be found pupils who do not fit into the work of the group. Special provision must be made for them. There are certain types of reading activities, however, in which even the best and poorest pupils of the class may participate profitably. For this reason any kind of classification should be flexible. There are numerous ways of providing for individual differences after the pupils have been grouped according to ability. Some of the methods employed are as follows:

1. Provide material suitable for the group. Too often teachers feel that material must be of a certain grade level. It is well to remember that the best educational procedure starts from the child and not from the materials.
2. Provide a classroom library to which the members of each group may have access at stated times.
3. Encourage children with the same interests and equal abilities to work on the same problems.
4. In the more formal assignments, provide a minimal assignment and suggest other work which may be done.

No set rule may be followed in dealing with children. Methods that succeed with some will fail with others. The teacher should determine by means of standardized and informal tests the needs of the various pupils with respect to skills and interests and plan a definite program.

Diagnostic and remedial measures in reading. The material treated under this topic is closely related to that of the one immediately preceding. Diagnosis in reading is concerned with the specific causes underlying a pupil's failure to profit by reading instruction as children of a similar age generally do. The importance of the teacher as a diagnostician has been recognized by a number of writers. McCall[1] lists the following prerequisites to success as a diagnostician:

> (1) A knowledge of the usual causes of usual defects in the various abilities developed by the school. (2) Eyes to see and training or experience to interpret subtle behavior as evidence of the operation of known causes. (3) A technique which will bring otherwise invisible hints to the surface. (4) A knowledge of what remedial measures to prescribe for a given diagnosis.

In a survey of the literature dealing with the causes of failure in reading, Gray[2] found those listed below "of greatest value in pointing out specific causes of failure in reading":

1. Inferior learning capacity
2. Congenital word blindness
3. Poor auditory memory
4. Defective vision
5. A narrow span of recognition
6. Ineffective eye-movements
7. Inadequate training in phonics

---

[1] McCall, W. A. *How to Measure in Education*, pp. 109–111. 1922. By permission of The Macmillan Company, publishers.

[2] Gray, W. S. "Remedial Cases in Reading: Their Diagnosis and Treatment," *Supplementary Educational Monographs*, No. 22, pp. 12–21. University of Chicago, Department of Education. June, 1922.

8. Inadequate attention to the content
9. An inadequate speaking vocabulary
10. A small meaning vocabulary
11. Speech defects
12. Lack of interest
13. Guessing *versus* accurate recognition
14. Timidity

Gray,[1] after examining the literature on diagnosis and making several studies, decided to organize his investigations around three major steps: (1) A thorough study was made of the child's history. School records, teachers, and parents were consulted and an attempt was made to locate any difficulties. (2) Standardized tests were administered and a thorough analysis made of the results in an attempt to locate the particular phases of reading in which the child was weak. Intelligence tests also were given in order to try to find a measure of the child's learning ability. (3) If the causes of reading deficiencies were not yet located, a more detailed study was made by observing the child in the classroom, securing lists of his errors, comparing him with other children, and giving him informal tests. If possible causes can be reduced to a comparatively small number for a pupil, it is not so difficult to construct from reading material, or adapt from standardized tests, types of tests that will determine whether the child has a particular type of difficulty.

After the causes for reading difficulties have been located, the application of remedial measures becomes the important problem. The remedial work will of course depend upon the types of difficulties found. In case the pupil is deficient mentally it may be that no better reading results should be expected. The chief task here is to see that the child has material from which he is able to profit. Gray[1] makes the following specific suggestions based on the study of a large number of cases:

---

[1] *Op. cit.*, p. 24.

(1) Individual instruction is preferable.

(2) The confidence and coöperation of the pupil must be secured.

(3) Keen interest must be aroused in reading through the use of material directly related to the pupil's interest.

(4) The first selections must be simple enough to enable the pupil to read with a fair degree of success.

(5) Specific problems should be assigned to direct his attention to the important points.

(6) These problems should increase in difficulty as his power of interpretation develops.

(7) The problems which are assigned must vary in order to include all important phases of interpretation.

(8) In connection with training in interpretation, he must be given exercises to promote rapid and accurate recognition of individual words and words in groups.

(9) Drill exercises to increase his span of recognition and to establish regular eye-movements should also be given.

(10) Exercises must be included to assist the pupil in reading rapidly as well as thoughtfully.

(11) As soon as the pupil has made some progress in accurate interpretation and in the mechanics of reading,

---

[1] *Op. cit.*, p. 186.

he should be assigned types of exercises which require independent thinking.

(12) He should also be encouraged to read as much as possible outside of class in order to secure a large amount of practice in reading which is necessary in establishing fluent habits.

(13) Remedial instruction should not be discontinued until pupils have substituted good habits for poor ones in all phases of reading and can read content subjects rapidly, intelligently, and independently.

QUESTIONS AND EXERCISES

1. Construct an informal test for some phase of reading.
2. Secure a number of reading tests and study them to determine just what phase of reading ability each test is supposed to measure.
3. Plot reading growth curves for Pupils A and E, Table LIII.
4. In Table LIV locate the pupils who lost during the summer vacation. Can you offer any reasons why some pupils gained while others lost?
5. Draw graphs for the reading scores given in Table VIII, page 61, similar to the graph given in Figure 7, page 177.
6. Check the provisions made for individual differences in a certain grade with Theisen's findings given in Table LVI.
7. What reading disabilities do you find in the grade?
8. If the Thorndike-McCall Reading Scale is available, administer it to a class of children and score the papers. Is the class an average one in achievement? Do you find pupils who make a score equal to the norm for the grade above?
9. Of what value is it for a teacher to know how her pupils score on a standardized test?

SELECTED REFERENCES

1. Brooks, F. D. "The Reliability of Silent Reading Tests," *School and Society*, Vol. XIX, p. 652. May 31, 1924.
2. Brooks, S. S. *Improving Schools by Standardized Tests*, pp. 143–233. Houghton Mifflin Company. 1922.
3. Gilliland, A. R., and Jordan, R. H. *Educational Measurements and the Classroom Teacher*, Chap. VII. The Century Co. 1924.
4. Gray, C. T. "Types of Reading Ability as Exhibited through Tests and Laboratory Experiments," *Supplementary Educational Monographs*, No. 5. University of Chicago. 1917.
5. Gregory, C. A. *Fundamentals of Educational Measurement*, Chap. II. D. Appleton and Company. 1922.
6. Hines, H. C. *A Guide to Educational Measurements*, Part I, Chap. XVIII. Houghton Mifflin Company. 1923.
7. McCall, W. A. *How to Measure in Education*, pp. 109–111. The Macmillan Company. 1922.
8. Monroe, W. S., DeVoss, J. C., and Kelly, F. J. *Educational Tests and Measurements*, Chap. III. Houghton Mifflin Company. 1924.
9. Smith, H. L., and Wright, W. W. *Tests and Measurements*, Chap. IX. Silver, Burdett and Company. 1928.
10. Trabue, M. R. *Measuring Results in Education*, Chap. XV. American Book Company. 1924.
11. Van Wagenen, M. J. *Educational Diagnosis*. The Macmillan Company. 1926.
12. Wilson, G. M., and Hoke, K. J. *How to Measure*, Chap. V. The Macmillan Company. 1920.

CHAPTER XVI

THE PSYCHOLOGY OF SPELLING

Until comparatively recent years spelling and reading were very closely related in the school curriculum. Many of the reading books prepared for the use of children in the elementary grades also had lists of words based on the reading lessons. The spelling lesson and reading lesson were frequently assigned at the same time. The spelling recitation in most cases was merely a part of the reading period especially devoted to spelling. Generally, the teacher "heard" the spelling lesson and then she "heard" the reading lesson. Naturally, since the two were so closely related, the spelling words were drawn from the words in the reading lesson. In fact, the chief value of spelling seems to have been considered as an aid to reading. The new words occurring in the reading material were arranged in lists for the spelling lesson. Probably this was a natural result of the method used in teaching reading. The pupils learned the alphabet and spelled the new words. It is needless to say that much of the material in the early readers was in no way related to the experiences of the child.

Spelling was also taught from long lists of words selected from the dictionary, or the dictionary was itself used as a textbook. Words were not selected because the child needed them, but various artificial classifications were made. During this educational period two aims seem to have been paramount. First, words were studied for the purpose of aiding the student in reading and, second, spelling was taught as a means of formal discipline. The formal discipline aim, however, was a later development and grew out of the movement which partially divorced reading and spelling through the use of separate texts. Spelling as we know it today is an outgrowth of the child study and the experimental psychology movements of a generation ago. These studies, which led to a knowledge of how words acquire meaning, how the child acquires new words, how words are perceived, as well as to a better understanding of the reading process, also led to a new concept of the relation of the individual to society. Once the relation of spelling to its practical use by the individual was comprehended, new aims were inevitable.

Present-day aims of the teaching of spelling. In connection with the aims of the teaching of spelling, we should state what the function to be developed is. It may be stated as the ability to use the correct letters in their proper sequence within words. The first and most important aim of the teaching of spelling is to develop within the child the ability to spell a word whenever he needs it. The need for the ability to spell is nearly always, if not always, one connected with written expression. The aim, then, might be stated as the ability to spell a word automatically when the individual is giving attention to the content of the material being written. This aim provides for the development of an ability which allows the individual to record his language reactions.

A second aim the teacher of spelling should strive for constantly is that of a spelling consciousness on the part of the pupil. In this subject, as in others, the development of a right attitude is of great importance. In developing a spelling consciousness the pupil must be made to realize his spelling defects and an incentive should be given to overcome them. Probably the most powerful motive for correct spelling is the social one. Few students early realize the attitude of society toward misspellings.

In most cases this aim can be realized if the pupil is able to understand that spelling defects are the result of careless habits formed early in life and not the result of a spelling disability. Attitudes toward spelling are formed early. A child gets the impression that he is naturally either a good speller or a poor one. If he is a poor one, he thinks nothing can be done about it. The pupil can be made to feel that there is a cause for his poor habits which he can remove, and the teacher can be of service in helping him find it. Once the pupil recognizes the cause of his poor spelling, it is possible so to motivate him as to produce marked improvement. One way of doing this is to have pupils keep lists of misspelled words and classify the errors for themselves. If a pupil has poor habits of observation, a knowledge of this weakness and a recognition of the importance of accuracy in observation, together with a little encouragement, will frequently influence him to remedy the defect and build up desirable spelling habits.

A third aim in the teaching of spelling is to give study techniques which will ultimately make the child independent and successful in his growth in spelling ability.

Economy in word lists. For the sake of economy in learning, it is important to know what words the children in each grade need to know. Fortunately, spelling is a subject which lends itself to scientific study. Horn, Tidyman, Thorndike, Jones, Washburne, and others have derived lists of words from careful investigations. The growth of the child in the use of language demands that two points of view be kept in mind. First, what words does the pupil need now to aid him in his thought processes as expressed in written work? Second, what words will he need as an adult? These two questions cannot be answered in a final way but they can be answered in terms of the average. The investigators mentioned above have derived word lists based on one of the following: (1) the children's compositions, (2) the correspondence of adults, or (3) words occurring in the reading vocabulary and in school work. Washburne[1] has attempted to construct a spelling vocabulary using words selected by other investigators. The ideal list, he thinks, should include words taken from correspondence of both children and adults. Table LVII shows the author, date, and source of material for the most important earlier studies. The more important recent studies were made by Thorndike,[1] Horn,[2] and Tidyman.[3]

---

[1] Washburne, C. W. "A Spelling Curriculum Based on Research," *The Elementary School Journal*, Vol. XXIII, pp. 751–762. June, 1923.

TABLE LVII. CONSPECTUS OF VOCABULARY STUDIES [4]

AUTHOR	DATE	SOURCE OF MATERIAL
Knowles, Rev. J.	1914	Passages from the Bible and Various Authors.
Eldridge, R. C.	1911	Articles of Sunday Newspapers.
Ayres, L. P.	1913	Personal and Business Letters.
Jones, W. F.	1913	Children's Compositions.
Cook, W. A., and O'Shea, M. V.	1914	Family Correspondence.
Nicholson, Anne	1914	Selected by Teachers and Supervisors from daily lessons.
New Orleans Public School List	1916	Children's School Work.
Kansas City Public School List	1916	Selected from pupils' misspelled words and teachers' judgment of words pupils should know how to spell.
Houser, J. D.	1916	Letters of Farmers.
Anderson, W. N.	1917	Written Correspondence of Iowa People.
Horn, E.	1918	Correspondence of Bankers to Bankers.

---

[1] Thorndike, E. L. *Teacher's Word Book.* Teachers College, Columbia University. 1921.

[2] Horn, Ernest. "A Basic Writing Vocabulary," *University of Iowa Studies in Education*, First Series, No. 4. 1926.

[3] Tidyman, W. F. "A Survey of the Writing Vocabularies of Public School Children in Connecticut," *Teachers Leaflet*, Bureau of Education, No. 15. 1921.

[4] Ashbaugh, E. J. "The Iowa Spelling Scales," *Journal of Educational Research Monographs*, No. 3, p. 8. June, 1922. Public School Publishing Company.

Class lists of words. Many teachers make a practice of selecting the spelling words from the written work handed in by the students. This is valuable as an auxiliary list but it is of doubtful value if it displaces lists worked out for children in general. In the first place, the practice has a tendency to restrict the vocabulary of the pupils in several ways. Children who do not know how to spell a word and know that they do not know how to spell it will likely substitute another for it, thus avoiding the word on which study is needed. Again, the teacher with limited time and resources is unable to make a list which will in any way compare in value to those made by the research worker who has facilities for extensive investigations.

The pupil should be required to keep his own list of words with which he has difficulty. Words which might be considered from the point of view of local or individual needs should be added. These concern local interests and activities only and are not included in the general list. There are also words which children become interested in because of some special occasion. From the point of view of maturity the word may belong at a higher level but, because of the special interest, it might be more economically learned upon the special occasion. The general word list must be considered as more or less a minimum to be learned by children everywhere. The individual list is made up of words from the general list which present individual difficulties plus the local list mentioned above.

Presentation of words. The method to be used in presenting words is one of the most important psychological problems connected with the teaching of spelling. The problem resolves itself into: How should the word be presented so as to secure the most economical learning? Although it is desirable for the child to react to the word by attentive spelling in a variety of situations, there are two lines of evidence which indicate that visual presentation is superior to any other one method. Children of the early school grades, in which a relatively large proportion of their spelling vocabulary is learned, have as a rule visual imagery predominating. Again, it is almost universally agreed that emphasis should be placed on written spelling because spelling is used primarily in writing. The close relation between the visual presentation of the word and its spelling when written is apparent. Furthermore, the researches dealing with the problem have shown that visual presentation is essential to superior achievement.

While it is true that the visual methods should receive the major emphasis, other methods should not be neglected. Children should have opportunities to hear, see, write, and spell orally under attentive conditions.

The length of the word plays an important part in learning to spell. In view of the great increase in difficulty with the increase in the length of words, as shown by errors, special attention should be given to the perception of words containing many syllables. In order to get a long word clearly before students it should be presented as a unit, and by syllables and letters. Several workers have found slight superiority in the teaching of the syllabicated form of a word. This method is probably more important for the early grades.

Another problem concerned with the presentation of words has to do with word grouping. What words should be presented together? In general, words which psychologically go together may with advantage be taught at the same time. In deciding whether words belong together psychologically, a test must be made in terms of the experience and need of the pupil and not in terms of similarities in sound or appearance. Authorities agree that artificial groups may be a detriment in learning to spell but do not agree as to the methods for teaching homonyms. Certainly homonyms should not be taught together simply because they are homonyms. However, if they are needed and occur together in the child's experience and are suitable for his mental age-level, they may be taught in close succession, provided one is definitely learned before the other is presented. This prevents confusion.

Tidyman and Johnson report an experiment to determine the value of grouping words according to common difficulties in spelling. Two lists of words of equal difficulty were selected. One group was arranged according to similarity of difficulties involved while the other group was arranged in random order as far as difficulties were concerned.

The words of the random order list were taken up in a chance order and studied according to the following plan:[1]

1. The word was written on the blackboard, pronounced, and used in a sentence or defined.
2. The word was written in syllables and pronounced slowly by syllables. The hard part of the word was decided upon and underlined.
3. The pupils closed their eyes and visualized the word.
4. The word was spelled aloud by the class and by individual pupils.
5. The word was written several times.
6. After each word was studied in this way, all the words of the lesson were written several times.

A period of twenty minutes was allowed for each lesson and no work was done outside of class. The same method of study was used with the list grouped according to difficulties except that the words having the same difficulties were pointed out. Two tests were given, one on Friday of the week in which the

TABLE LVIII. SHOWING RESULTS OF EXPERIMENT TO DETERMINE SUPERIORITY OF GROUPING OR NON-GROUPING METHOD (AFTER TIDYMAN AND JOHNSON)

	NON-GROUPING METHOD	GROUPING METHOD	% SUPERIORITY OF G. METHOD
Friday Test . .	68.5	81.2	13
Monday Test .	58.9	69.5	10

---

[1] Tidyman, W. F., and Johnson, Edith. "Value of Grouping Words according to Similar Difficulties in Spelling," *Journal of Educational Research*, Vol. X, No. 4. 1924.

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE

words were studied and one about three months later. The results summarized in Table LVIII show great superiority for the method in which grouping according to similar difficulties was employed.

Attitude or mental set. Arps[1] studied the effect of forming a general attitude toward a group of words as contrasted with forming an individual definite attitude toward each of the words in a group. In the study, groups of words of approximately the same difficulty were used. One group was assigned as a unit. The words were studied and recalled in a fixed order. The words of the second group were assigned, studied, and recalled in random order. The method of study used with the first group of words built up definite spatial and temporal relations between the words of the group. For the second group no such relations were possible because the words were considered in random order. As one would expect, the method which considered the group as a unit was more economical for immediate spelling. However, after a lapse of time, the second method proved far more economical.

Several explanations of the results may be offered. In the first place, pupils learn to spell words in relation to position and order in a series, if the words are so assigned. In immediate recall, the spatial and temporal factors probably help in the recall while the words learned in a random order have no such helps. These helps are of immediate benefit but as soon as the word is taken out of the group or placed in another setting they cease to function. On the other hand, words learned in random order probably are reacted to more directly. Instead of temporal and spatial relationships being emphasized, the word itself receives more attention. Such factors as pronunciation and meaning are stressed.

---

[1] Arps, G. F. "Attitude as a Determinant in Spelling Efficiency: Immediate and Delayed Recall," *Journal of Educational Psychology*, Vol. VI, pp. 409–418. 1915.

Ability and achievement in spelling. At present we know very little concerning the relationship which exists between ability to learn to spell, based on scores made on standardized spelling tests, and mental ability as measured by the several intelligence tests. Various correlations have been found between the two abilities as measured, but these do not tell us just what degree of spelling ability is to be expected with a certain degree of mental ability.

Wilson [1] states that reading and spelling correlate much more closely with general mental ability than does arithmetic. Houser [2] found a correlation of .53 between spelling ability and general intelligence (Binet), .62 between spelling ability and meaning, and .39 between meaning vocabularies and general intelligence. It would be hard to explain why the correlation would be lower between meaning and intelligence, and one would scarcely have expected this. The large correlation between spelling ability and meaning is significant and emphasizes the close relationship between the two abilities. Burt,[1] in discussing the backwardness of defectives, states, "In spelling and dictation, the defective ranks far below his level for intelligence: the difference is greater even than for reading, probably greater than for any other subject."

---

[1] Wilson, F. T. "Some Achievements of Pupils of the Same Mental Ages but Different Intelligence Quotients," *Journal of Educational Research*, Vol. XIV, pp. 43–53. June, 1926.

[2] Houser, J. D. "The Relation of Spelling Ability to General Intelligence and to Meaning Vocabulary," *The Elementary School Journal*, Vol. XVI, pp. 190–199. 1915.

The writers have found coefficients of correlation between spelling ability, as measured by the Ayres Spelling Scale, and mental ability, as measured by the Stanford Revision of the Binet-Simon Scale, ranging all the way from .39 to .83. The efficiency of the teaching, as well as other factors, tends to influence the size of the correlations. Of 31 such correlations the median one in size is .57 and the mean .58. Probably a correlation of approximately .55 might be considered typical. The correlations between the measurements made in the lower grades are higher than between those in upper grades. The averages for the grades are given in Table LIX. The table shows that the relationship is much closer in the early grades. The data are taken from a school system, where, at least in theory, spelling is taught all the way through the grades but in an incidental manner in the upper grades. This latter fact undoubtedly has something to do with the decrease in the size of the correlations in those grades.

---

[1] Burt, Cyril. *Mental and Scholastic Tests*, pp. 287–296. P. S. King and Son, Limited, London. 1922.

TABLE LIX. SHOWING CORRELATION BETWEEN SCORES MADE ON THE AYRES SPELLING SCALE AND MENTAL AGE AS MEASURED BY THE STANFORD BINET-SIMON SCALE

	GRADE							
	2	3	4	5	6	7	8	9
Average Correlation .	.73	.68	.62	.64	.58	.52	.43	.39
Number of Correlations	2	4	4	6	5	4	5	1
Total Number of Cases	67	124	127	192	164	131	170	54

The writers have not found relationship quite so close between group intelligence test scores and spelling scores. Correlations as follows were secured between the tests listed in Table LX:

TABLE LX. SHOWING CORRELATIONS BETWEEN SPELLING AND INTELLIGENCE TEST SCORES

TEST	GRADE			
	3	4	5	6
National A	62	64	51	47
Otis Primary	56	56		
Otis Advanced			49	40
Number of pupils	124	127	192	164

It will be noticed that in general the relationship is closer for the lower grades. The Otis Test gave slightly lower correlations. This test was administered to the children first and this fact may account for the lower correlations as the writers have other objective evidence that a second testing gives higher measures of relationship than a first.

In Table LXI Gates[1] presents the results of a study in diagnosis and specific instruction as applied to a group of children retarded in spelling. The large gains in the lower grades are especially significant.

Table LXI. Scores in Spelling Tests in Terms of Percentage of Correct Spellings of Equivalent Lists Selected from Ayres-Buckingham Scale

Grade	Score Nov. 1	Score Jan. 15	Score May 15	Improvement in Years (*a*)
III	21	40	55	1.7
IV	29	52	69	1.8
V	42	63	82	2.2
VI	40	57	70	2.0
VII (*b*)	61	63	66	0.4
VIII (*b*)	59	62	64	0.4

Note. (*a*) Figures in this column are improvements expressed in terms of average improvements achieved by American schools in general (Ayres norms). Grades III–VI used the special method. (*b*) Grades VII and VIII had little specific instruction in spelling.

The table shows that, although these children were considered retarded in spelling, by means of specific instruction an unusual gain was achieved. Grades VII and VIII, in which the instruction was of a general nature, made little gain. Many children are poor spellers because of the type of teaching they have received and not because of lack of native ability.

---

[1] Gates, A. I. "The Psychology of Reading and Spelling," Teachers College, Columbia University, *Contributions to Education*, No. 129, p. 83. 1922.

Maturity and sex and achievement in spelling. There are wide individual differences between any age groups whether taken with the sexes together or separate. When taken as a whole, however, each age group surpasses the preceding group. Tidyman [1] states that the increase from 9 to 12 is about twice that from 12 to 15. The influence of maturity and sex within a grade is shown in Table LXII. The percentile scores are shown for ages 11, 12, 13. It will be noticed that the girls are superior to the boys at every age. Also it will be noticed that the younger pupils in the grade tend to do better than the older. This probably shows the effect of brightness since there is a tendency for the bright children to be accelerated and the dull retarded. In material for the other grades the same general conditions are true as shown by data not given here.

Imagery. At least three forms of imagery are used in spelling — visual, auditory, and motor — in addition to various combinations of these. As has been shown by a number of studies, individuals cannot be classified as to types of images. Starch [2] states that most people have all types of imagery which are combined in different degrees for different persons. While it is true, as previously stated, that children in the early grades are predominantly visual

---

[1] Tidyman, W. F. *Op. cit.*, p. 138.

[2] Starch, Daniel. *Experiments in Educational Psychology.* (Revised Edition.) The Macmillan Company. 1917.

TABLE LXII. SHOWING AGE-GRADE-SEX PERCENTILE SCORES BASED ON COLUMN "S" OF THE AYRES-BUCKINGHAM SPELLING SCALE [1]

SIXTH-GRADE BOYS

PERCENTILE	AGES		
	11	12	13
High	20.	20.	20.
90	18.2	17.5	17.
80	17.3	16.4	16.4
70	14.8	13.2	12.8
60	13.3	11.7	11.6
50	12.3	11.4	10.5
40	10.8	10.2	9.8
30	9.6	9.2	8.4
20	7.3	6.8	6.7
10	4.4	4.1	4.2
Low	2.	2.	3.
Number of Pupils	42	209	145

SIXTH-GRADE GIRLS

PERCENTILE	AGES		
	11	12	13
High	20.	20.	20.
90	19.	19.8	18.9
80	17.9	19.5	17.5
70	16.7	17.8	15.7
60	14.8	16.4	14.4
50	14.3	15.	13.4
40	13.7	14.4	11.3
30	13.	12.4	10.
20	10.2	10.8	7.8
10	7.	6.	6.1
Low	4.	5.	5.
Number of Pupils	179	60	27

---

[1] Garrison, S. C., and Ryan, Florence. "Age-Grade-Sex Percentile Norms for Certain Educational Tests," *Peabody Journal of Education*, Vol. I.

in their imagery, this form is less pronounced in the higher grades.

Since all materials must be presented through the senses and individuals are not of pure types, the first step in teaching spelling should be the presentation of the word so as to employ visual, auditory, speech-motor, and hand-motor images. The word should be clearly pronounced several times in order that the pupil may secure clearness of imagery. He should be allowed time to get a mental picture of the word, thereby allowing for the use of any preferred type of imagery he may have. Speaking and writing the word is a process of securing and testing for clear imagery. Dividing the word up into syllables is also of advantage in getting a clear image of the word. Kline [1] found in a study of imagery that, for individuals with preferred types of imagery, interference with that type in the learning of spelling gave poorer results. When the preferred type was used, errors were eliminated more rapidly. Interference with any type of imagery would probably increase the number of errors. This would amount to a failure to present words in a way to make use of an individual's total ability to learn and would indicate that it is important to pay especial attention to the presentation of words.

Mead [2] used two groups of children to study the effects of drill as opposed to imagery. He called one group the Drill Group and the other the Visual Group. In reality the visual group seems to have been the Imagery Group in that the words were presented in almost all possible ways. The children of this group saw the word written, pronounced it, copied and spelled it. The drill group on the other hand was handled in the following manner: The word was dictated to the first child, who pronounced and tried to spell it. If he did not succeed, the next child tried, and so on until the word was correctly spelled. The next word was then taken up. This oral drill method was used entirely with this group of children. The Visual Group gained more than twice as rapidly as the Drill Group but when a retention test was given one week later the Drill Group was found to have made a further gain while the Visual Group had made a slight loss. The study might be considered as presentation *vs.* drill and shows the importance of emphasizing the entire learning process in teaching spelling. It is important in presenting words to use the child's entire ability in imagery, but drill and review must not be neglected.

---

[1] Kline, W. L. "A Study in the Psychology of Spelling," *Journal of Educational Psychology*, Vol. III, pp. 381–400. 1912.

[2] Mead, C. D. "Spelling by Visualization *vs.* Drill Methods," *Journal of Educational Psychology*, Vol. V, pp. 29–31. 1914.

Memory. Memory processes as used in spelling consist in making associations between the letters of the word in a forward order and between the letters and the sound and meaning of the word. The general principles of learning apply to spelling as to any other subject. The letters of the word must be associated together in the proper order. Economy in learning demands that if the word is to be spelled correctly it be presented in such manner as to secure the greatest interest and attention as well as clear perception.

The relation between ability to remember certain types of material and spelling is given in terms of coefficients of correlation in Table LXIII.

TABLE LXIII. SHOWING RELATION BETWEEN CERTAIN MEMORY TESTS AND SPELLING ABILITY[1]

Rote memory for geometrical forms and spelling	.46
Rote memory for digits and spelling	.39
Rote memory for words and spelling	.31
Rote memory for nonsense syllables and spelling	.43
Logical memory for prose and spelling	.34

Number of children = 104.

One hundred and four children in the Peabody Demonstration School were given the tests mentioned in the table and the results were correlated by the writers with scores from the Ayres Spelling Scale. It will be noticed that memory for geometrical forms gave the highest correlation and memory for words lowest. Clear pronunciation and attentive repetition under properly motivated conditions make for economy in processes involved in learning to spell.

Pronunciation. Another problem dealing with the presentation of the word has to do with pronunciation. Suzzallo[1] lists three methods through which the child may get the pronunciation of a word:

---

[1] Garrison, S. C. "Variation in Achievement and Ability within the Grades," George Peabody College for Teachers, *Contributions to Education*, No. 8. 1922.

> (1) He may obtain it by imitation of a sound model, through the speech of his teacher, or his fellow students. (2) He may obtain it through direct phonetic translation of the letters in the word, that is, by means of such conventional and artificial devices as diacritics, syllabication, and phonograms, or through the analogies in form between the words he can pronounce and the new word which he cannot. (3) He may utilize both the methods just mentioned, adding such additional techniques as are needed to get the pronunciation from the dictionary.

Probably the first is much the most important. Teachers need to watch the pronunciation the children have acquired outside the school, since by far the largest number of a child's experiences occur in the home, on the playground, and in other situations over which the teacher does not have supervision. Gates[2] found a correlation of approximately .5 between the ability to pronounce words and spelling ability. It is obvious that it is important for children to have correct sound images of words they are to learn to spell.

Meaning. Unless the teacher has a rather clear idea of the nature of the development of children she is likely to lose sight of the principle of the orderly growth of the individual. Before a child can have a need for a word he must have an idea of its meaning. Frequently, words occur in the class list which have little relation to the previous experiences of the children. In the lower grades this problem is taken care of better than in the upper in that the activities of the pupils themselves are generally made the basis for selecting spelling words. The teacher can never be sure that children know the meaning of words until after they have learned to use them with insight. The safest thing to do is to have all the words used in written and oral work. While there is no evidence on the question, pupils probably forget more readily the spelling of words when the meaning is not clear. Hollingworth[1] found a correlation of .55 between the ability to spell and the ability to use words. She says:

---

[1] Suzzallo, Henry. *The Teaching of Spelling*, pp. 58–59. 1913. By permission of, and arrangement with, Houghton Mifflin Company.

[2] Gates, A. I. *Op. cit.*, p. 40.

> *Knowledge of meaning is probably in and of itself an important determinant of error in spelling; that children will produce about sixty-six and two-thirds per cent more of misspellings in writing words of the meaning of which they are ignorant or uncertain, than they will produce in writing words the meaning of which they know.*

Lack of knowledge of the meaning of a word also is conducive to negligent and careless ways of reacting toward a word. Our spelling lists are made for children in general and not for the child in particular. Words stand for certain types of experiences and if social aims are to be realized all children must receive a minimum of these. However, words are often assigned when the child has no basis in experience for them. Before words are taught, the child should have gained a basis for them through experience. He should acquire meaning and then ability to spell. The spelling of a word, the meaning of which the child does not already have, should neither be expected nor required.

---

[1] Hollingworth, Leta S. "The Psychology of Special Disability in Spelling," Teachers College, Columbia University, *Contributions to Education,* No. 88, p. 57. 1918.

QUESTIONS AND EXERCISES

1. List aims for the teaching of spelling. How have these changed in recent years?
2. Why is the research dealing with word lists valuable? Look up one of the word lists mentioned for the purpose of learning how it was constructed.
3. Outline a method, based on this text, of presenting words to children. Would you vary this method from grade to grade or from age to age?
4. Could you give your attitude toward spelling? Do you consider yourself a good or a poor speller? How early was your attitude toward spelling formed?
5. Study the results of a spelling test. Note the wide range of ability found within a grade. What factors do you think may account for such differences as are found?
6. Observe a spelling lesson in the elementary grades. Note provisions for individual differences, methods of motivation, and any study helps the teacher has given the pupils.

SELECTED REFERENCES

1. Barr, A. S. *Elementary School Standards for the Improvement of Teaching*, p. 150. Edwards Brothers. 1924.

2. Cook, W. A., and O'Shea, M. V. *The Child and His Spelling.* Bobbs Merrill Company. 1914.
3. *Fourth Yearbook of the Department of Superintendence of the National Society for the Study of Education,* "Research in Constructing the Elementary School Curriculum," Chap. IV.
4. Kline, W. L. "Study in the Psychology of Spelling," *Journal of Educational Psychology,* Vol. III, pp. 381–400. 1912.
5. Mead, C. D. "Spelling by Visualization *vs.* Drill Methods," *Journal of Educational Psychology,* Vol. V, pp. 29–31. 1914.
6. Suzzallo, Henry. *The Teaching of Spelling.* Houghton Mifflin Company. 1913.
7. *Third Yearbook of the Department of Superintendence of the National Society for the Study of Education,* "Research in Constructing the Elementary School Curriculum," Chap. IV.
8. Thorndike, E. L. *Teacher's Word Book,* Teachers College, Columbia University. 1921.
9. Tidyman, W. F. "A Survey of the Writing Vocabularies of Public School Children in Connecticut," *Teachers Leaflet,* No. 15. U. S. Bureau of Education. 1921.
10. Wallin, J. E. W. *Spelling Efficiency in Relation to Grade, Age and Sex, and the Question of Transfer.* Warwick & York, Inc. 1911.

CHAPTER XVII

THE PSYCHOLOGY OF SPELLING (*Continued*)

Selection and drill. ~~The first~~ principle ~~of learning~~ to spell is similar to that employed whenever habits are to be formed. This principle relates to the selection of the correct response. It is evident that no amount of repetition would ever fix the correct spelling of a word unless the correct response is the one upon which drill is centered. Drill must be emphasized only after the teacher is sure that the correct response has been selected. The correct spelling of the word must be presented and the pupil's attention focused on it before drill begins. A second principle is concerned with overlearning. The correct spelling must be drilled upon until it is fixed. Frequent reviews are necessary to counteract forgetting. A third principle of drill is concerned with motivation. Sufficient incentive to secure attentive drill is necessary for economical learning. The importance of this principle has not been sufficiently realized by teachers.

Time, which probably means a number of repetitions, is not the most important factor in learning to spell. Studies have shown that there is little relation between the amount of time devoted to spelling and the results achieved. This indicates that other factors, such as motivation, are of great value. Time is undoubtedly important when good methods are used. On the other hand, with poor methods drill may be worse than useless.

Another question dealing with selection and drill relates to the use of rules in spelling. In general, experimental work shows that the use of rules under existing conditions is of comparatively little aid in selecting the correct spelling and probably hinders in drill. The evidence, however, is conflicting. There are times when the attention of the pupil might be profitably called to the rule governing the spelling of the word. Generally, however, spelling should grow out of correct observation of words and not by reference to some artificial device.

Motivation. Proper motivation is a part of good teaching. Perhaps it is the most important part. The teacher should have some large plan for the work of the semester. Miss Martin[1] reports a scheme she tried in which the children bought cheap notebooks and made their own spelling books. The spelling period was largely devoted to individual work with a weekly test on Friday. The main points of her method of teaching spelling are well worth quoting because they served to arouse an interest in the subject. Briefly her main points are:

1. Definite assignments for a somewhat extended period of time.
2. Careful use of uniform notebooks.
3. Review and trial lesson of week's work on Monday.

---

[1] Martin, G. E. "The Teaching of Spelling," *The Elementary School Journal*, Vol. XXI, pp. 201–207. University of Chicago, Department of Education.

4. More teaching and less testing.
5. Individualization of the child's problem.
6. Weekly test on Friday.
7. Posting of individual and class records to remain permanently in view.
8. Encouragement for each to surpass his own record.
9. The general plan of the week's work varied enough to keep interest and enthusiasm at the highest point.

From the foregoing outline of Miss Martin's method it will be noticed that she used the factors calculated to motivate the work in spelling. Her assignments were definite and the plan was understood by the children. There were tests and uniform notebook work at definite intervals. Furthermore, the children were kept interested in the outcome by individual and class comparisons.

In spelling, as in other subjects, it is necessary that pupils have a definite, attainable, worth-while goal and that they realize it as such. Frequent tests are also necessary in order that the students may see how nearly they are achieving the goal and how their achievement compares with that of others.

The teacher and motivation. Children seem to become interested in the things in which a teacher whom they like takes an interest. Careful and accurate checking on written work with constructive suggestions personally called to the attention of the pupil and followed up later in an individual manner makes for the proper attitude toward spelling. The plan of having children keep all their written work during the year in folders has been tried very successfully.

Book reviews, themes, and other compositions, when gone over carefully by the teacher, should be handed back to the students, who file them — each in his own folder. These folders are collected and kept in one place but each student may look over his own at any time. This affords a means of comparing work produced at one time of the year with that done at another. Children are motivated by the idea of doing better work and when the teacher can show them comparisons in an objective way a further stimulus to accurate spelling is added. "Like father like son" is true in genetics. "Like teacher like pupil" is equally true if the teacher has a high sense of accuracy and other habits which are desirable in the development of spelling ability.

Tests and motivation. In the George Peabody College Demonstration School, standardized tests are given frequently. It has been the custom to plot the scores in the form of a graph, as shown in Figure 7, page 177, and to place the graph where all pupils may see it. On this graph are drawn horizontal lines which indicate the grade norm, the achievement of the grade being tested, and the norms for the grades immediately below and above. This furnishes a basis for group rivalry. Also the results of the test administered when the pupils were in the grade below are made available so that any pupil may compare and note his progress as well as the progress of the group.

Numerous devices based on rivalry or play have been employed in motivating spelling. These are worth while only when they help attain the spelling aims. After all, the chief aim of spelling is the ability to reproduce the word correctly in written material. Probably this aim can only be reached after pupils are made to feel that the goal is a worthwhile one. It is desirable occasionally to introduce games and the play spirit into the work but care must be taken that this does not provide training which defeats the building up of higher and more permanent interests in spelling.

Transfer. An important problem raised in connection with the teaching of spelling is whether words learned in one setting, say column dictation, are spelled correctly in contextual material; only those methods are efficient which further this aim. A number of investigations have been made to find out whether words taught in column dictation were correctly spelled in written material. Opposite conclusions have been stated by research workers. Tidyman and Brown[1] found, as have others, that there was a loss from column presentation of about 11 per cent. Other investigators have found little loss. However, as Tidyman and Brown point out, these latter investigators in their experiments took no account of the words used which the children already knew how to spell and which had probably been learned in both column and contextual settings.

---

[1] Tidyman, W. F., and Brown, Helen A. "The Extent and Meaning of the Loss in 'Transfer' in Spelling," *The Elementary School Journal*, Vol. XVIII, pp. 210–214. 1917.

Apparently, these studies in transfer justify a mixed procedure. Column dictation probably has some advantages in the economy of time and motivation. A real mastery of the word demands that it be spelled when the child's mental processes are centered on the thought being expressed and not on the spelling of the word. This would seem to mean that drill must be furnished in written material as well as in column dictation.

Mead,[1] in studying misspelled words in English and sociology themes, found that there were 160 per cent more misspelled in sociology themes than in English themes. A number of research workers have found similar conditions. It is almost universally recognized that training in language work in general does not carry over to the other school subjects to the extent desired. This seems to be especially true of spelling. Several reasons may be stated for this condition of affairs. The point of view of the teacher or the general aim of the subject determines the points students will emphasize. In English work, spelling is an important item and all teachers of English recognize it as such. Not only is spelling recognized as important but the teachers of English have a definite technique for dealing with errors in spelling which teachers of other subjects are ignorant of or in which they are not interested. Consequently, an error in spelling made in the English class would be promptly called to the attention of the student and steps taken to secure the correct spelling. In another subject the error might be marked, but very likely that would end the matter. The psychological explanation of this difference lies in the fact that in English work students center their activities largely upon spelling, usage, and form, while in other fields their activities have to do with the subject matter involved. If spelling is to be taught effectively, a spelling consciousness must be developed which functions in all work.

---

[1] Mead, A. R. "Transfer of Spelling Vocabulary," *Journal of Educational Psychology*, Vol. VIII, pp. 41–44. 1917.

Order of psychological processes in learning to spell a word. Horn [1] recommends that one method of learning to spell be used. He found after an examination of the experimental literature that there does not seem to be justification for a different method for each individual according to his imagery type. He states, "We may recommend one method for all, with the conviction that in practice it will get results which are, on the average, superior to what the pupil would get if he should work out a method for himself, or to what would be gotten should the teacher work out a method for him." The following set of rules was worked out to embody the conclusions he reached as the result of various experimental investigations made in the University Elementary School at the State University of Iowa in regard to the economy of learning.

---

[1] Horn, Ernest. "Principles of Method in Teaching Spelling as Derived from Scientific Investigation," *The Eighteenth Yearbook of the National Society for the Study of Education*, Part II, pp. 71–72. Public School Publishing Company.

How to Learn to Spell a Word

1. The first step in learning to spell a word is to pronounce it correctly. If you do not know how to pronounce a word, look up the pronunciation in the dictionary. When you are certain that you know how the word is pronounced, pronounce it, enunciating each syllable distinctly and looking closely at each syllable as you say it.

2. Close your eyes and try to recall how the word looks, syllable by syllable, as you pronounce it in a whisper. In pronouncing the word be sure to enunciate the syllables carefully.

3. Open your eyes to make sure that you were able to recall the correct spelling.

4. Look at the word again, enunciating the syllables distinctly.

5. Recall again, with closed eyes, how the word looked.

6. Check again with the correct form. This recall (as in 2 and 5) should be repeated at least three times, and oftener if you have difficulty in recalling the correct form of the word.

7. When you feel sure that you have learned the word, write it out without looking at the book, and then check with the correct form.

8. Repeat this two or more times, looking either at the book or at your previous attempts.

9. If you miss the word on either of these trials, you should copy it in your spelling notebook, since it probably is especially difficult for you.

Classification of errors. In diagnosing the spelling disability of a child it is important to make an objective classification of the errors which he makes.

It is not enough to know that a child spells with only a certain per cent of accuracy, because increased emphasis on spelling without any change in the teaching procedure may not change his relative spelling efficiency. If a pupil's errors are classified, the teacher will be able to determine upon what to concentrate the efforts of the school. Several good classifications of errors are available.

Burt[1] gives two classifications, "one from the standpoint of the error and one from the standpoint of the individual making the error." His classifications in condensed form follow:

A. Classification from the standpoint of errors.
  1. Substitutions — The incorrect letter resembles the correct one in form, sound, or in movements necessary for writing.
  2. Omissions — One of two letters made by similar movements or resembling each other in sound is omitted.
  3. Insertions — Similar to 2 above except letters are added.
  4. Transposition of letters or syllables.
  5. Duplication and repetition — The duplication of a single letter or repetition of a number of letters.
  6. Anticipation and perseveration — A letter is moved forward in the word or one already used is moved backward.
  7. Articulatory — The incorrect letter represents the incorrect pronunciation.

---

[1] Burt, Cyril. *Op. cit.*, pp. 291–294.

B. Classification from the standpoint of the pupil.

1. Lapses — The child knows the correct spelling but is momentarily unable to give it. These errors are not as a rule repeated.
2. Inventions — The child does not know the word and invents a spelling of his own.
3. Habitual errors — Here the child has learned an incorrect spelling.
4. Idiosyncrasies — Here the child makes some characteristic error as adding an extra letter.

Hollingworth[1] gives a useful classification which is somewhat different from Burt's. This classification emphasizes the errors children make although they know the correct spelling and can correct the error as soon as it is pointed out or in carefully going over their written work. Errors of this type are due generally to carelessness. Hollingworth, following earlier writers, speaks of these errors as lapses. Children making such errors must receive a sufficient amount of training to develop habits of careful observation and automatic control. The classification arrived at in a psychological study of lapses is as follows:

a. Errors which result from automatically copying the ending of a word that is just *above* the word being spelled,

$$\textit{e.g.}\quad \left\{\begin{array}{l}\textit{closet}\\ \textit{clockt}\end{array}\right.$$

b. Errors which result from automatically including a syllable of a word that is to *follow* the word being written, and which is therefore coming "to mind" as that word is being finished, *e.g.*, "postard card." This seems to occur especially when there is marked *similarity* between the two syllables, as in the example given.

---

[1] Hollingworth, Leta S. *Op. cit.*, pp. 38, 39.

c. Errors which result from a tendency to omit, in written spelling, one of two letters which require a similar motor process for their execution, *e.g.*, "sd" for "sad," and "gld" for "glad."

d. Errors which result from writing a letter that has common kinaesthetic elements *instead of* the correct letter, *e.g.*, "dod" for "dog" and "forn" for "form." (In such cases the nervous system seems to satisfy itself with executing a part instead of a whole.)

e. Errors which result from substituting a letter that has common visual elements instead of the required letter, *e.g.*, "goiny" for "going" and "shorekeeper" for "storekeeper."

f. Errors (very common) which result from substituting a letter that has common phonetic elements for the required letter, *e.g.*, "celect" for "select," and "podchees" for "potcheese."

g. Errors which result from transposing two adjacent letters, as is so often done in typewriting, *e.g.*, "Indain" for "Indian," and "mintue" for "minute."

h. Errors which result from perseveration of an element, especially a dominant element, in a word just used, *e.g.*, "the theeth," for "the teeth."

i. Errors which result from a tendency to omit the last letter of the word being written, when the initial letter of the next word has the same or a similar sound, *e.g.*, "advise to" for "advised to."

j. Errors due to doubling the wrong letter in a word which contains a doubled letter, *e.g.*, "frezze" for "freeze."

In the same study another type of error is pointed out which is probably closely related psychologically to lapses. A few children were found who were inclined to make the same kind of errors consistently. The error here is largely one of pronunciation. The pupil introduces into the spelling an *intrusive letter* which he generally uses in pronouncing the word. The following examples are taken from the study :[1]

h-u-s-d-b-a-n-d — husband
v-i-s-i-n-t-i-n-g — visiting
d-e-a-r-l-a-r — dealer
f-a-r-t-h-e-r — father
m-a-n-e-r-g-e-r — manager
s-u-r-g-a-r — sugar
a-u-t-o-n-m-o-b-i-l-e — automobile

Wells,[2] in discussing linguistic lapses, says :

> There are four normal linguistic processes, two sensory, the visual and the auditory, and two motor, the phonetic and the graphic. . . . Each of the above linguistic processes is subject to its own peculiar lapse. . . . A lapse is the involuntary modification of any linguistic sensation or movement to another linguistic sensation or movement. The process itself is always central, no matter what its source of excitation. . . . Lapses are not only involuntary, they are for the most part also unconscious, *i.e.*, there is no awareness of them until their primary memory has been lost. . . . Inattention is the first requisite of the lapse. . . . It has yet to be determined that, so far as the higher mental processes are concerned, the lapse is anything other than a product of inattention, which permits the disturbing element to enter

---

[1] Hollingworth, Leta S. *Op. cit.*, p. 40.

[2] Wells, F. L. *Linguistic Lapses*, Archives of Psychology, Columbia University.

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE

consciousness, and the law of suggestion, which permits it, when there, to express itself in a corresponding perception or movement.

Errors have been classified in a number of ways by research workers. In addition to Burt and Hollingworth, many others have made classifications and discussions worthy of study but lack of space forbids their being presented here.

Position of error in words. Hollingworth[1] found that errors made in 700 spellings were distributed as follows:

	Initial Syllable	Intermediate Syllable	Ultimate Syllable	Total
Polysyllables . .	19	52	31	102
Dissyllables . . .	37		60	97
Monosyllables . .	28			28

Hollingworth states that "the first elements in words have a decided advantage over final elements, and that both first and last elements have a distinct advantage over intermediate elements." From learning experiments dealing with nonsense syllables this is what one would expect. Ayres[2] found a correlation between length of word and spelling difficulty of .88. In order to determine whether the difficulty increased as a result of additional syllables,

---

[1] Hollingworth, Leta S. *Op. cit.*, p. 42.

[2] Ayres, L. P. *A Measuring Scale for Ability in Spelling*, pp. 38, 39. Russell Sage Foundation. 1915.

Hollingworth compared the spelling difficulty of monosyllables and polysyllables. Practically no difference was found between the two classes of words. In speaking of the findings she states,[1] "The difference here shown is insignificant. It would lead us to the conclusion that we were correct in assuming that the difficulty of words depends, other things being equal, upon the number of *letters* which they contain, and that the number of *syllables* is not the important factor." This would seem to be in harmony with conclusions reached by others, that there is very slight, if any, superiority in learning when the syllabicated form of the word is taught.

TABLE LXIV. SHOWING PER CENT OF ERROR FOR EACH OF THE LETTERS, ACCORDING TO POSITION (AFTER HOLLINGWORTH)

	No. of Words	1	2	3	4	5	6	7
Words of six letters	34	6	18	9	29	32	21	
Words of seven letters . . .	36	3	3	8	37	42	44	28

Hollingworth[2] further studied the per cent of error for each of the letters of words of six and seven letters. The results given in Table LXIV show the importance of accurate observation when words are presented. Few errors occur in the initial letter, but letters near the middle of the word are much more likely to be wrong. This fact is similar to the conditions found in reading. The first part of the word is more clearly noted in reading than the middle and last. The final part, however, is probably noted more than the middle. The initial and final parts of a word give cues to its meaning and little attention is given to the middle parts.

---

[1] Hollingworth, Leta S. *Op. cit.*, p. 44.

[2] *Ibid.*, p. 50.

Cause, prevention, and treatment of errors. It is obvious that any systematic attempt to prevent or treat errors must be based on good methods of teaching and learning. In diagnosis the teacher must always determine whether the errors under investigation are due to wrong habits of spelling or whether they are due to lack of definite habits. Some pupils spell a word wrong time after time and always spell it the same way. In these cases an incorrect spelling of the word has been learned and it is therefore necessary to change fixed habits. In another case the pupil spells a word in different ways. Here no definite habit has been formed. The two types of cases demand somewhat different treatment. In dealing with the error of the first type it is not absolutely necessary that a teacher arrive at a conclusion as to the cause of the error, however desirable this may be; but in diagnosing a pupil's difficulties in spelling in general, it is highly important that each pupil's errors be correctly understood.

Economical learning demands that children learn to spell correctly from the first. It is a needless waste of energy to allow the formation of poor habits which must later be replaced with correct ones. Children cannot be divided into types, but in general the following ways of reacting when impressions from words are received should be considered: by visualizing the word, by hearing it, by motor activities, and by ways of reacting which involve various combinations of these three. There probably are few children, if any, of a purely visual, auditory, or motor type. The same child reacts to different words in different ways and, in fact, at different times, to the same word in a different way. This depends partly upon the context or setting in which the word occurs. How one reacts to a word is largely a matter of training. Our methods of teaching spelling generally do not make the fullest use of the ability of children to react in various ways. As a rule, the words are presented in a uniform way. If the aims in spelling are to be realized, children must be given opportunities to react to words in different ways in different situations demanding written responses.

The two primary causes of bad spelling are negligence on the part of the pupil and inability to spell. Negligence is synonymous with poor habits or poor attitudes toward the spelling work. This is closely related to poor methods of presenting words to the pupils. In this case the word is not properly reacted to for the purpose of learning how it is spelled. Words should be heard, seen, and written correctly. In addition, attention should be called to difficult parts. The middle syllables of a word should always be considered difficult. Proper presentation on the part of the teacher makes for accurate observation on the part of the pupil.

Interest. Various devices have been used by experimenters in studying the interest factor in the teaching of spelling. Most of these have utilized the importance of rivalry as a strong factor in securing interest. Games, play, drills, and other activities which furnish opportunities for friendly competition have been used. Spelling ability is easily measured and lends itself to activities where definite comparisons can be readily made. Students like to compete with each other and with themselves when there is an impartial observer who steers the contest and keeps interest alive by the proper encouragement.

There are several important points to be observed in attempting to create interest in spelling: (1) There must be constant comparison with the record kept. Interest is easily lost if the teacher does not call attention to past as well as present achievements. The pupils should know what the results are. (2) Devices must not be imposed by the teacher. Pupils should help plan games. They should help make the rules and outline the procedure. (3) Children like to help select words for study. In a contest between groups to reach a certain standard, added interest is attained if each group selects words from the word lists for the other group. In case there is an attempt to reach certain standards, the pupils may be allowed to "weed out" words they already know and concentrate on a few of the harder ones each day. By helping one another, group coöperation is secured and thereby added interest. All people like to be active and to feel that they are helping to "put something over." Spelling furnishes one of the best opportunities for making use of the original and acquired interests of the pupil.

Unfavorable causes of a general nature. Many pupils are unable to do good school work because of unfavorable habits and attitudes developed in response to an environment not conducive to the work of the school. Lack of interest, positive dislike for school, feelings of inferiority, outside interest, poor home conditions, a feeling that school work is not worth while, and many other habits and attitudes make for failure in spelling.

Prevention of errors. Teachers will never be able to prevent all errors in spelling if for no other reason than that they do not entirely control the environment of the child. It is possible, however, so to arrange the school environment and motivate the child as to secure much greater efficiency in spelling. Proper study habits, the development of a spelling consciousness, a realization of the social motive, and careful checking on the part of the pupil for errors, are aids in the prevention of wrong habit formation. Because it aids in the early detection of the inability to spell a word, the test-study method is of value in preventing wrong habit formation.

Treatment of errors. Nowhere is greater skill required than in the arrangement of school work and the motivation of the pupils in such a way as to substitute correct habits for incorrect ones. The good teacher is fully aware that it is not enough to find and check errors. It has been shown by experiment that the checking of papers and handing them back to students helps very little in correcting errors. Unfortunately, the attitude has developed that written work is to be handed to the teacher to be graded and then probably handed back with a grade on it. Everything the teacher does should be directed toward learning on the part of the pupils. Papers do not constitute just so much additional work but are part of the teaching situation. Misspelled words should be used as a spelling list. It is necessary with such words to secure clear and accurate presentation with appropriate reactions of attention and drill. Reviews are valuable in dealing with misspelled words.

Disability in spelling. The term disability has been applied to persons who have very poor spelling ability and who seem unable to learn to spell. Burt[1] seems to hold that there is a special spelling factor and that children who do not possess this are unable to develop spelling habits. Hollingworth[2] thinks that probably there are a few children who possess spelling disability, that is, they do not possess the traits necessary for learning to spell. In her investigation she found several children to whom she ascribed such a lack of ability. In the study dealing with poor spellers she says:

> We found in our experimental work that a number of the poor spellers were lacking merely in interest and application. The ability to form bonds was present, but

---

[1] Burt, Cyril. *Op. cit.*, p. 94.

[2] Hollingworth, Leta S. *Op. cit.*, p. 97.

> motivation was lacking. The tedious, voluntary effort required for forming the thousands of bonds involved in learning our arbitrary English spelling was too irksome for them. When devices to make learning "interesting" and "worth while" were employed, and when rewards of value *to the child* were offered, these poor spellers improved rapidly, and lost all semblance of inability to spell. . . . But after all the poor spelling due to lack of motive, weak general intelligence, failure to attend, sensory deficiencies and weak power of sustained effort was accounted for, there still remained a residue of poor spelling which resulted from none of these causes, but from an innate inability to form some or all of the special bonds requisite for spelling words.

These statements would seem to commit the author to the point of view that some special innate ability is absent, the lack of which places the child in a separate group from children who are poor spellers for more general reasons.

Gates,[1] on the other hand, after examining Hollingworth's point of view and after an intensive psychological investigation into the causes of backwardness in reading and spelling, states:

> Such extreme cases, we believe, are to be explained on the basis of a combination of particular unfavorable traits, some of which are quite likely to be overlooked under the limitations of present diagnostic technique.
>
> The enormous complexity of the process of learning to read or spell can scarcely be appreciated in our present state of knowledge. . . . We should expect from the

---

[1] Gates, A. I. *Op. cit.*, pp. 102, 103.

laws of chance enormously varying permutations and combinations of these particular abilities. When the infrequent combination of many favorable traits is found, we have an aptitude for spelling; when a similarly complex combination of unfavorable factors is found, we have a "disability" for spelling.

The weight of the evidence seems to be against the theory of a special disability in spelling. What is known of brain physiology and recent researches in that field all point in the opposite direction. Poor memory, poor motor coördination, sensory deficiencies, nervous instability, lack of interest, poor early training, poor health, poor writing, and inertia, all are unfavorable for spelling efficiency. A combination of several of them may render learning almost impossible. A combination of factors of the opposite sort may make for great efficiency in spelling. A pupil who is able to learn only the easiest words is different only in degree from that one who has spelling ability to such an extent as to be classed as a genius in spelling. There are no sharp differences to be found between those possessing in varying degrees the abilities which are conducive to good spelling.

If we were able to assign to each child a score for that combination of abilities which function in learning to spell, these scores when plotted would likely tend to conform to the normal probability curve. Pupils possessing much ability would fall at the upper end of the curve while those possessing very little would fall at the extreme lower end. The latter would represent those pupils who are barely able to learn a few of the easiest words.

Diagnosis and remedial instruction in spelling. The first step in the diagnosis of spelling difficulties is to find how the individual or individuals compare with children in general. For this purpose it is necessary to secure measures on a standardized spelling test. A good intelligence test also should be used. The following questions, answers to which will aid in diagnosis, should be answered in the light of the test results for the group as a whole:

1. Is the median of the grade up to the standard?
   a. Is a large majority below the norm for the grade?
   b. Is a large majority above the norm for the grade?

2. How does spelling achievement compare with mental ability?
   a. Is spelling achievement below mental ability rating?
   b. Is spelling achievement above mental ability rating?

3. Are the pupils correctly classified according to age?
   a. Are there many over-age students in the grade?
   b. Are there many under-age students in the grade?

4. When chronological age, mental age, and achievement in spelling are compared, are the children doing the work in spelling which should be expected?

5. When all the factors in 4 above are compared with the work in the other school subjects, are the children doing work in spelling which compares favorably with what one would expect on the basis of mental ability and achievement in the other school subjects?

By means of the above comparisons the teacher should secure a fairly clear picture of the general condition of the spelling situation in the grade. If the grade as a whole is up to or above what might reasonably be expected in the light of chronological age, mental age, and general environmental opportunities, the teacher is next ready to turn her attention to the pupils who are below the norm for the grade, as given by the standardized test, as well as to those pupils whose achievement or psychological rating shows that they are not making the achievements in spelling that they should. If the grade as a whole is below what should be expected, the teacher should seek the general cause. Such factors as these should be sought: poor methods of teaching; lack of coöperation on the part of other teachers, in case of departmental teaching; poor early training in habits of study for the group as a whole. Once the cause is found the teacher knows what effort must be made to remedy the condition. Proper presentation of words, proper checking and drills, and above all proper motivation will remedy most group situations.

If the comparisons show a favorable group situation but a few pupils failing to achieve what should be expected of them in spelling, the diagnostic and remedial work becomes more of an individual matter. Here there are probably individual causes rather than a more general cause. A careful check should be kept on the type of errors made by the poor spellers and these compared with the causes listed under the topic "Cause, Prevention, and Treatment of Errors." A few of the most common causes of poor achievements are listed under the paragraph, "Disability," but probably should be repeated here with additional ones. We have previously listed these causes under two large heads: carelessness and inability to spell; a more detailed classification follows.

a. Poor memory
b. Poor motor coördination (Speech defects, etc.)
c. Sensory deficiencies (Poor vision, etc.)
d. Nervous instability
e. Lack of interest
f. Poor health
g. Poor early training
h. Poor writing
i. Inertia
j. Poor spelling consciousness
k. Improper pronunciation
l. Poor study habits
m. Faulty visual perception

After the teacher has determined the cause for poor achievement in spelling, a mode of procedure must be followed with each pupil according to the cause for his spelling condition. Too many teachers make the mistake of giving poor spellers just an extra dose of what they are already getting by way of instruction. This frequently leads to an extra period after school. Instruction should be based on the needs of the pupil. If poor achievement is due to poor writing, teaching must take that fact into account. Spelling, because its results can be handled in an objective way, is one of the easiest subjects in which the teacher may motivate students. Records showing improvement after causes have been pointed out and remedial instruction started will generally bring about a new interest in improvement.

For purposes of diagnosis and motivation, records should be kept over a period of years. Standardized tests given each year at a stated time, with scores kept and arranged so that pupils and teachers may compare this year's work with last year's or even that of several years before, furnish a basis for comparison and diagnosis which is invaluable. Table LXV shows the spelling scores of pupils in a small school system as they progressed from the second grade through the eighth. The only pupils listed are those who remained in school the whole period. By inspection it may be seen that the pupils as a whole did poorer work in certain years than in others. It is interesting to note how a few pupils make a steady gain from year to year while others are irregular in their growth. Data like this when kept as a permanent record is very valuable in school work.

Measuring spelling achievement. Not only should the teacher give frequent tests to determine how well the pupils are profiting from the spelling work and for the purpose of making individual lists of words, but standardized tests should be used also for the purpose of comparing the progress of individuals, as well as the group as a whole, with other groups and with established norms. Such questions as those

TABLE LXV. SHOWING RESULTS OF SPELLING TESTS ADMINISTERED IN SUCCESSIVE YEARS

PUPIL	GRADE						
	2	3	4	5	6	7	8
1	18	17	19	19	19	18	18
2	18	17	18	20	19	18	18
3	18	19	19	20	19	20	18
4	18	18	19	18	20	20	17
5	17	18	18	19	18	18	17
6	17	17	18	17	19	18	19
7	17	16	17	18	17	18	17
8	17	17	13	18	20	18	17
9	17	17	19	18	18	20	18
10	17	16	17	16	17	17	16
11	16	17	16	18	17	18	14
12	16	16	15	16	18	16	19
13	16	15	18	18	18	16	16
14	16	16	17	16	19	15	16
15	16	16	15	16	18	17	16
16	15	16	16	16	17	17	18
17	15	17	17	15	18	17	16
18	15	12	14	9	14	19	18
19	15	14	17	14	16	16	12
20	15	16	16	18	18	19	15
21	15	14	17	17	16	15	15
22	15	14	16	15	16	17	15
23	15	15	16	16	17	20	15
24	15	15	16	15	17	18	14
25	15	16	15	17	19	16	14
26	14	14	15	14	16	15	16
27	14	15	14	14	18	20	16
28	13	15	15	16	17	13	14
29	13	15	16	12	17	15	18
30	13	13	15	13	17	13	14
31	13	14	15	14	16	15	15
32	13	11	13	14	12	16	13
33	13	11	10	11	16	16	14
34	12	13	15	14	14	13	15
35	12	13	11	10	14	18	12
36	12	13	11	13	18	13	13
37	12	15	13	16	19	14	11
38	12	11	18	13	12	14	9
39	8	8	8	9	10	12	6
40	7	8	9	8	10	9	8

NOTE. These scores were secured by means of the Ayres Spelling Scale. Words were selected from the column in which the grade was supposed to spell 73 per cent of the words. Twenty words were dictated at each testing. The tests were made at the middle of the school year.

that follow can be answered by means of a standardized spelling test: How does this class compare with other classes of the same grade? What improvement should be expected during the year? What is the educational classification of each of the pupils in the grade? How do the individual pupils in this grade compare in spelling ability with children in lower and higher grades? What overlapping is there between grades? It is evident that such questions can be answered only in terms of a standardized spelling test.

Buckingham [1] made the first important contribution to the measurement of spelling ability. He prepared several spelling scales, one for each grade and one for all the grades. Ayres [2] selected the one thousand most common words from a number of studies of the words found in the writings of children and adults. These words then were divided into lists and teachers were asked to dictate them to their pupils according to a uniform procedure. Approximately 1,400,000 spellings by 70,000 children were secured. From these spellings, columns of words were arranged in steps of equal difficulty. Buckingham has recently added five hundred words to the original list. These words were added chiefly at the upper end of the scale. The scale is of value in that lists can be selected from the several columns for spelling tests. At the top of each column is given the per cent of the words of the column spelled correctly by the pupils of the several grades. Starch [1] selected 300 words at random from a dictionary. Certain types of words were eliminated. This is a good random list but is of no value as a measure of pupil achievement in spelling since it contains a large number of words not found in the spelling lists used in school. The Iowa Spelling Scale was developed by Ashbaugh.[2] In this scale approximately 3000 words were used. Each word was spelled by not less than 200 children. This probably is the best standardized scale available. There are a number of other tests available, including the Monroe Timed Sentence Spelling Test and the Morrison-McCall Spelling Scale.

---

[1] Buckingham, B. R. "Spelling Ability, Its Measurement and Distribution," Teachers College, Columbia University, *Contributions to Education,* No. 59. 1913.

[2] Ayres, L. P. *Op. cit.*

The Ayres scale has been used more widely than any other. In the strict sense of the word this is not a spelling test but a list of words from which a smaller list may be selected as a test. In selecting words from the Ayres list, various workers have selected from different columns for the same grade. The writers have found that as a rule the column in which the grade to be tested spells 73 per cent of the words correctly is satisfactory. The column must not be too easy or some of the pupils will spell all the words. On the other hand, the column must not be too difficult for just the opposite reason. In the case where the column is so easy that some of the pupils spell all the words, spelling ability is really not measured. Twenty words seem to be enough for a test. These may be dictated to the pupils or they may be employed in sentences. In scoring, the per cent correct is the pupil's score. This score may be compared directly with the per cent of children who spelled correctly the words in the column from which the test was taken. Reference to Table LXV, page 399, shows the number of words spelled by pupils at seven yearly testings. The tests were all given at the midpoint of the school year.

---

[1] Starch, Daniel. *Educational Psychology*, p. 324. The Macmillan Company. 1919.

[2] Ashbaugh, E. J. The Iowa Spelling Scale, *Journal of Educational Research Monographs*, No. 3. June, 1922.

QUESTIONS AND EXERCISES

1. Outline a procedure for the development of a spelling consciousness.
2. Make a note of methods you have known teachers to use in developing class lists of words. What are the advantages and disadvantages of such lists?
3. Visit a spelling class and notice how the teacher presents new words to the class.
4. In your visit to a spelling class, what provision in the teaching did you find made for the exceptional child?
5. List methods of developing interest in spelling. What methods have you known teachers to use? Which do you consider of most intrinsic merit?
6. Study the spelling scores listed in Table LXV. In the first column the scores are arranged from best to poorest. Do you find a tendency in the other columns for the scores to fall in a similar order?

7. How could you find a numerical value which would express this tendency?

8. Secure a spelling scale and measure a grade.

9. Select several words which you do not know how to spell and learn them. Notice your method of learning. Have some friend learn the same words. How do your methods compare?

SELECTED REFERENCES

1. Ashbaugh, E. J. "The Iowa Spelling Scales," *Educational Research Monographs*, No. 3. University of Iowa. 1922.
2. Ayres, L. P. *A Measuring Scale for Ability in Spelling*. Russell Sage Foundation. 1915.
3. Davis, Georgia. "Remedial Work in Spelling," *The Elementary School Journal*, pp. 615–626. April, 1927.
4. Gates, A. I. "Psychology of Reading and Spelling with Special Reference to Disability," Teachers College, Columbia University, *Contributions to Education*, No. 129. 1922.
5. Gilliland, A. R., and Jordan, R. H. *Educational Measurements and the Classroom Teacher*, Chap. V. The Century Co. 1924.
6. Hollingworth, Leta S. "The Psychology of Special Disability in Spelling," Teachers College, Columbia University, *Contributions to Education*, No. 88. 1918.
7. Hollingworth, Leta S. *Special Talents and Defects*, Chap. V. The Macmillan Company. 1923.
8. Horn, Ernest. "Principles of Method in Teaching Spelling as Derived from Scientific Investigation," *The Eighteenth Yearbook of the National Society for*

the Study of Education, Part II. Public School Publishing Company. 1925.

9. Horn, Ernest. "A Basic Writing Vocabulary," *University of Iowa Studies in Education*, First Series, No. 4. 1926.
10. Monroe, W. S., DeVoss, J. C., and Kelly, F. J. *Educational Tests and Measurements*, Chap. V. Houghton Mifflin Company. 1924.
11. Paulu, E. M. *Diagnostic Testing and Remedial Instruction*, Chap. VI. D. C. Heath and Company. 1924.
12. Reed, H. B. *Psychology of Elementary School Subjects*, Chap. XIV. Ginn and Company. 1927.
13. Starch, Daniel. *Educational Psychology*, Chap. XVIII. The Macmillan Company. 1927.
14. Sudweeks, Joseph. "Practical Helps in Teaching Spelling: Summary of Helpful Principles and Methods," *Journal of Educational Research*, pp. 106–118. September, 1927.
15. Thorndike, E. L. *Teacher's Word Book*. Teachers College, Columbia University. 1921.
16. Tidyman, W. F. *The Teaching of Spelling*. World Book Co. 1919.

CHAPTER XVIII

THE PSYCHOLOGY OF HANDWRITING

Aim. The general aim in the teaching of handwriting is to develop in the child the ability to record automatically, by means of graphic signs, his language reactions. The ability has a twofold function. By so recording, the child is able to compare his present reaction with a future one. This is but another way of saying that through handwriting he is able to organize his thinking and to think more accurately. In many situations, one is unable to arrive at a correct conclusion the first time. But by writing the first reaction and comparing it with later ones, it is possible to work out a more nearly correct statement. In this way handwriting aids the student in his thinking. The second function of handwriting has to do with the communication of thought. Here the purpose may be the recording of thought for one's own future information or for its communication to another.

Specific aims. General aims are important in that they furnish a general point of view with respect to the subject under discussion. They help orient us in our thinking and furnish a guide by means of which more specific aims may be evaluated. The specific aims of handwriting have been variously stated.

The Fourth Yearbook of the Department of Superintendence [1] lists the following aims and objectives:

1. To develop sufficient skill in pupils to write easily, legibly, and rapidly enough to meet present needs and social requirements.
2. To equip the child with methods of work so that he will attack his writing problems intelligently.
3. To diagnose individual writing difficulties.
4. To aid the child to recognize and make use of his peculiar individual learning capacities.
5. To provide experiences which will tend to develop in the child more power to direct his own practice and more ability to judge whether or not he is succeeding in that practice.
6. To provide the means for each individual to progress at his best rate.
7. To develop an appreciation of the relationship between correct body adjustment and an efficient writing production.
8. To secure acceptable and customary arrangement and form for written work (margins, spacing, etc.).
9. To develop a social urge to use the skill attained in all writing situations.
10. To train pupils to be able at the end of the sixth grade to write quality 60 (Ayres scale) or better, and at a rate of 70 letters per minute or better.

Standards for judging handwriting instruction. Teachers are aware of the fact that their work must be based on abilities already developed. In the case of handwriting in the early grades, the work should be very closely related to the language work in general. Drill is probably more effective when it is not necessary for the pupil to divide his attention between securing the meaning of different words and the writing process. Progress in the development of skill in handwriting may be judged with regard to the two following points: (1) from the point of view of the writer and (2) from the point of view of the reader. These questions may be asked with respect to the first point of view: Has the skill become automatic? Does the degree of skill permit such speed on the part of the writer that it does not interfere with the process of thinking?

---

[1] *The Department of Superintendence of the National Education Association, Fourth Yearbook,* pp. 113, 114. February, 1926.

One of the main functions of language is to aid the child in his thinking. He readily acquires a degree of skill in spoken language which is automatic. As he advances in the grades his writing should become more and more automatic. Many pupils write well when easy material is being copied and when attention is being given to the writing process. Such pupils frequently write poorly when it is necessary to concentrate on the content of the material being written. Writing under such conditions is poor because the pupil must divide his attention between the writing process and the content of the material being written. This makes for a poorer quality of written work as well as a poorer quality of writing. *Automatization* of the writing process, then, is one of the objectives of training in handwriting.

Again, many pupils are able to produce fair specimens of writing when plenty of time is given but, when it becomes necessary to write at a more rapid rate, legibility suffers and the quality of material produced is of poorer quality. The ability to write rapidly, *speed*, is another important object of training in handwriting. It is an ability which is almost necessary for successful school work and for efficient thinking in case the work is being written.

The second point of view to be considered in handwriting is that of the reader. The ability to write so that others may readily read, *legibility*, is another and probably the most important objective of handwriting instruction. The first two objectives stated have to do with the production of language as reaction. The last has reference to written language as a situation to which the reader reacts. It is important that the legibility be such that the writing can be read without the reader's mental activity being divided between deciphering poor word forms and the content.

The proper arrangement of the writing on the page is also an aid in reading and this should be considered one of the objectives of handwriting instruction. The pupil should learn in the intermediate grades the mechanics of handwriting.

Time devoted to handwriting instruction. At present no one knows definitely just what amount of time devoted to handwriting in any specific grade is most economical. There are certain psychological considerations, however, which should be taken into account. The practice periods may be longer with older children than with younger because the more firmly habits are established the less easily will conditions of fatigue arise. Young children who are unskilled in writing are much more easily tired than are older. Practice periods should, then, be shorter for children in the early grades. If it seems desirable to place more than usual emphasis on instruction in writing, it is probably better to use more frequent practice periods rather than to lengthen those already provided. A period ten to fifteen minutes in length is probably the most desirable for drill in the primary grades. In the higher grades, if more time is needed, the period may be lengthened somewhat.

Studies have shown that there is little relation between the amount of time devoted to handwriting instruction and achievement. There are many factors favoring or hindering improvement. Most of these have not yet been studied in isolation. It is conceivable that in longer practice periods much irrelevant or positively injurious learning takes place. After the pupils become fatigued or the drill becomes dull and monotonous, very probably the movements are less skilfully made. Continued drill under such conditions tends to establish wrong habits.

Habits of neatness in all written work are not insisted upon by many teachers, while others lay stress upon the quality of handwriting in all written work. The achievement of pupils in handwriting may be a result largely of the attitude of the teacher in this respect.

Writing a complex process. The act of writing is not so simple as it may appear to the adult who is far removed from the initial stages of learning. One has only to watch a child in the primary grades laboriously writing, and to recall as best he can his own early efforts, to realize that writing is a complex process composed of many skills which are more elementary. One of the best ways of realizing the complexity of the writing habit, and at the same time realizing the labor and discouragement involved in the early stages of learning, is to attempt to write backwards.

On the purely motor side handwriting consists in the movements of many muscles all so coördinated that habitual responses may be made in writing. On the perceptual side the individual recognizes letters, words, and groups of words. The movements are made in response to situations composed largely of words. In writing, a certain mental set or attitude is taken by the individual and this in turn conditions the writing response. The purpose for which the material is written gives a mental set which enters into the total writing complex.

Children at different stages will show various degrees of maturity in the writing habit. At first the child laboriously writes words by looking at the letters and copying them. Frequently, children copy without recognizing words that are familiar. Later the words as a whole are copied just as they are perceived and finally whole thought units are written with little or no attention devoted to the letters or individual words. The writing ability to be developed, then, may be considered from two aspects, the motor and the perceptual. Each of these may in turn be analyzed into a number of more elementary phases. There are those which relate to word knowledge and meaning and those which relate to movements.

Movements. Most of the experimental work on the teaching of handwriting has been concerned with problems of movement. Writing involves much more than movements which produce symbols on the page, however; the main problems in handwriting are concerned with associative and perceptual processes. The other problems of handwriting are taken care of to a large degree in the development of oral and recognition vocabulary.

The question concerning the relative advantage of finger or arm movements is the one which has been most investigated and about which there is still disagreement. There are those who believe that pupils should be trained in the use of arm movements exclusively. The chief argument for this is that finger movements are fatiguing. Probably the real cause of fatigue in finger movements, however, is not a result of the movements themselves; but with unskilled writers the movements are not properly coördinated and much useless effort is made in holding the pen or pencil too tight and making unnecessary movements. Freeman's experiments seem to confirm the view that writing should involve a coördination of both finger and arm movements. He made pictures of the hands of a large number of adults and children while they were writing. These pictures were then projected on a screen and studied. His conclusions, which are given here, seem to point out that skill in handwriting is secured by a proper coördination of both arm and finger movements. Training in the use of arm movements exclusively really means not only training of a positive kind in the use of arm movements but training which inhibits finger movements as well. Many students of the problem think it well-nigh impossible to train pupils so that arm movements exclusively are made, even if such a method should be desired.

The movements by which the letters are produced may be classified into those of the whole arm, of the hand as a whole, of the wrist joint, and of the fingers. None of the classes of writers who were examined wrote without finger movement and all classes used about the same percentage; that is, good writers used as much finger movement as poor writers, and those who had been trained in the use of the arm movement particularly used as much finger movement as did the pupils who had not been so trained. The writers who had been trained in the use of arm movements used somewhat less hand movements and therefore more arm movements than did those who had not been so trained. The child cannot acquire the arm movement, even though it is made a direct object of drill, until he has acquired a certain amount of maturity and skill. A moderate degree of arm movement, however, will follow from the type of drill which was given in the present study. This drill did not have as its direct purpose the development of arm movement and nothing was said about the movement of the arm in the course. The exercises which had for their purpose the development of freedom and fluency of movement, however, resulted in the acquirement of a certain degree of movement of the arm. Contrary to the prevailing opinion, a close relation was not found to exist between the degree of arm movement and either speed or the form of the writing. Such degree of arm movement as is profitable may readily be developed as a by-product of the type of training which has for its purpose the development of fluent and easy sideward movement of the hand across the page and does not require the great emphasis which is put upon it by modern systems of penmanship.[1]

Handwriting as habit. The skills developed in learning to write are based on movements and abilities previously acquired. Through a coördination of these the child learns to write. Concerning the proper development of a habit so that it will function in an automatic way, psychologists have given much information which has a practical bearing on teaching. Several of these points should be held in mind in teaching handwriting. In the first place it is important that the handwriting habits be not too firmly established at an elementary stage. Often the pupil fails to pay attention to the details of his handwriting and falls into habits of producing poorly written material. On the other hand, as Freeman points out,[2] the pupil may pay attention to the details of the writing process too long. In this case he is always conscious of the movements necessary to produce letters and words. If the habit does not become automatic, the pupil is seriously hampered in his ability to express himself accurately and in good style. Children should probably be trained so as to develop one style of handwriting which should be used on all occasions with only such modifications as may be necessary at times for increased speed. Pupils should be expected to write on all occasions in their best style. One set of habits should not be developed during the writing period and another used at other times.

---

[1] Freeman, F. N. "The Handwriting Movement," *Supplementary Educational Monographs*, Vol. II, No. 3, p. 17. University of Chicago, Department of Education.

[2] *Ibid.*, p. 23.

Speed and quality in handwriting. There are two problems connected with speed and quality in handwriting. The first is concerned with the relation between speed and quality. Is there a positive relation between speed and quality? If so, does this relation hold for those who write with high quality or low quality? The second is concerned with the teaching of handwriting. Should the aim in drill at the beginning be to develop speed and later quality? Or should it be to develop quality at first and later speed? Or should it be to develop the two together?

With respect to the first problem there is much quantitative evidence. In general, correlations computed between speed and legibility have been positive but small. The studies seem to show that beyond a certain point a high degree of legibility is accompanied by a decrease in speed and a high degree of speed by a decrease in legibility. With normal development of speed and legibility, a small positive correlation may usually be expected. This means that there is little relation between speed and legibility but that there is a slight tendency for normal increase in legibility to be accompanied by increase in speed. The writers have calculated the correlation between legibility and speed for 27 grade groups. These correlations range from −.17 to .45 with a median of .19. Of the correlations, 21 are positive and 6 either zero or negative.

In regard to the second problem there is less experimental evidence. In some schools the practice is to put emphasis on legibility at first and to develop speed afterwards. Just the opposite practice is sometimes found in other schools. The best method seems to be to develop the two together. There is no definite experimental evidence as to which is the better method, but from what we know concerning habit formation and the development of children it would seem that the habit should be developed as it will be used later. This means that speed and legibility should be developed at the same time. Handwriting is to be regarded as composed of many elementary habits highly integrated into one unified whole.

Growth in handwriting ability. In order to compare the growth of a pupil in handwriting at one age with his growth during a later period, some sort of measuring instrument is necessary. Freeman[1] investigated the handwriting of children in a number of cities. In this investigation he secured samples of handwriting and graded them for legibility according to the Ayres scale. A measure of speed was secured by having the pupils write for two minutes. The number of letters written per minute was found and taken as a measure of speed. The results of Freeman's investigations are presented in Table LXVI. The scores listed here show the average attainment in handwriting by grades for a large number of pupils. On the basis of his study Freeman proposes the standards given in Table LXVII. These are in terms of scores on the Ayres scale. The materials presented in the tables indicate how children on the average improve from grade to

---

[1] Freeman, F. N. *The Fourteenth Yearbook of the National Society for the Study of Education,* Chap. V, p. 76. Public School Publishing Company.

TABLE LXVI. AVERAGE SPEED AND QUALITY UPPER AND LOWER HALVES IN ALL THE SCHOOLS INVESTIGATED

	SCHOOL GRADE						
	II	III	IV	V	VI	VII	VIII
Speed							
Average Upper Half . . .	35.4	47.7	56.2	64.9	69.2	73.4	77.8
Average Lower Half . . .	24.4	37.4	43.4	49.9	52.8	58.5	61.2
Average of All	30.6	43.8	51.2	59.1	62.8	67.9	73.0
Quality							
Average Upper Half . . .	43.5	46.1	49.3	54.5	58.5	64.7	67.8
Average Lower Half . . .	36.8	38.8	43.2	47.4	51.5	54.2	57.6
Average of All	39.7	42.0	45.8	50.5	54.5	58.9	62.8

grade. Most writers agree that the fundamental handwriting habits should be sufficiently established by the end of the sixth grade. After this it is only necessary to see that the pupils maintain skills already established. Children who have a speed of 90 letters per minute and who write with a quality equal to 70 or better should certainly be excused from further drills. For ordinary purposes 80 and 60 would probably be more desirable standards.

TABLE LXVII. PROPOSED STANDARD FOR QUALITY AND SPEED

	SCHOOL GRADE						
	II	III	IV	V	VI	VII	VIII
Quality	44	47	50	55	59	64	77
Speed	36	48	56	65	72	80	90

Left-handedness and handwriting. One of the most serious problems confronting the teacher of handwriting is what to do with left-handed children. There is a great deal of psychological evidence which tends to show that interference with left-handedness is directly associated with speech troubles. While psychologists are not agreed on the causes operating to produce left-handedness, it is undoubtedly a physiological condition. If a child is only slightly left-handed or if he is able to learn to write with the right hand readily and with no accompanying speech troubles, he may be taught to write with the right hand. It must be remembered that a left-handed writer is at a serious disadvantage; but even though this is true it may be dangerous for him to change to the right hand in writing. This makes a rather weighty problem for the teacher who is not only responsible for the child's growth in handwriting but for his total well-being.

Interest and motivation. Since handwriting is merely a means of expression and has little or nothing to do with the content of the thought expressed, it is frequently necessary to use devices for motivation which have little intrinsic worth. West[1] studied the problem of the use of incentives in teaching handwriting in order to find out whether their use is of value. He found that a great majority of teachers use incentives and believe that they are valuable. He found the following plans in operation:

1. The granting of certificates by some authority.
2. The granting of diplomas by some authority.
3. Extra points added to grades for good work in handwriting.
4. Various devices used for recognition, as stars.
5. The giving of prizes.
6. The use of group competition.
7. The use of individual competition.
8. The granting of special privileges.

As West points out, most of the incentives are artificial and have little intrinsic worth. In every school subject the highest incentives are those which lead to a mastery of the subject because of its own worth. Handwriting is no exception to the rule but it seems much more difficult to teach so as to develop what might be called a writing consciousness. Handwriting is worthy of one's best efforts because it is a vehicle for expression and has the same relation to the written word that proper or faulty pronunciation has to the spoken word.

---

[1] West, Paul V. *Changing Practice in Handwriting Instruction*, pp. 74–75. Public School Publishing Company. 1927.

One of the best means of motivating the learning of a pupil is to have him measure the speed and quality of his writing at intervals and keep a record of his achievement. Most pupils are interested in their own improvement. In some of the school subjects the work is of such character that the pupil cannot measure his progress objectively. In handwriting, however, this is not the case. Facilities for measuring specimens of the pupil's work, together with facilities for making comparisons with grade norms and standards for the class, furnish a means whereby the pupil may be made aware of his progress. The incentive to improve is a powerful and worth-while one and the teacher will do well to use it in motivating handwriting. Records may be taken from time to time and compared with previous ones.

Intelligence and handwriting. The relation between skill in handwriting and intelligence as measured by tests is positive although the coefficients of correlation found are usually small. For an unselected group of pupils of the same grade, an average of .37 was found for eleven correlations between intelligence as measured by the National Intelligence Tests and handwriting when measured by the Thorndike scale.[1] Practically no relation exists between the Stanford-Binet mental age and the handwriting of superior children. Tests made on five groups of children with median I.Q.'s of 112 or above yielded an average correlation of −.07 when the age factor was kept constant. Slightly higher correlations were found between intelligence and speed in handwriting.

TABLE LXVIII. SHOWING AVERAGE CORRELATIONS CORRECTED FOR UNRELIABILITY OF THE MEASURES AND THE PARTIAL CORRELATIONS, AGE ELIMINATED

Mean of 12 r's, writing with Binet MA	0.55
Mean of 6 r's, writing with age	0.82
Mean of 6 r's, Binet MA with age	0.73
Mean of 12 r's, writing with N.I.T.	0.80
Mean of 6 r's, N.I.T. with age	0.75
Partial r, writing with Binet MA (age constant)	0.01
Partial r, writing with N.I.T. (age constant)	0.48

Gates[2] combined scores in quality and speed to secure a score of general writing ability. He studied the relation between this combined score and intelligence. Table LXVIII gives his correlations. Basing his conclusions on his own and other data, Gates says it is not impossible that the relationship between writing ability and intelligence is positive for inferior pupils, slightly positive for average pupils, slightly positive for unselected children. The same line of reasoning would lead one to conclude that the relationship would be of a negative order for gifted children. This is exactly what the writers have found to be true for gifted children in the Peabody Demonstration School.

---

[1] Garrison, S. C. *Unpublished Materials*, The Peabody Demonstration School, George Peabody College for Teachers.

[2] Gates, A. I., and LaSalle, Jessie. "A Study of Writing Ability and Its Relation to Other Abilities Based on Repeated Tests During a Period of Months," *Journal of Educational Psychology*, Vol. XV, pp. 205–216. April, 1924. Warwick & York, Inc.

Measurement in handwriting. In handwriting, as in the other school subjects, it is highly desirable to make measurements at stated intervals and at such other times as may seem desirable. The two aspects of handwriting which lend themselves to measurement are speed and quality. There are a number of important uses to which measurements in handwriting may be put. The teacher needs to know whether the individual pupil is writing as well as he should and whether he is developing skill as he progresses through the grade. By making measurements of the pupils' abilities in handwriting from time to time the teacher is able to see which pupils are making progress. Such handwriting records serve also as a stimulus to the children in that they are able to know just where they stand with respect to the skills involved. Pupils are able to measure their own writing and keep a progress chart. Devices of this kind furnish a powerful means of motivation.

Speed in handwriting is measured in terms of the number of letters written per minute. The usual procedure is to have the pupils memorize a short selection and then write this continuously for two minutes. The number of letters written per minute is taken as a pupil's speed score. It is best for the teacher to use the material given for the scale which she will use in scoring for quality. For example, the Freeman scale uses the sentence, "A quick brown fox jumps over the lazy dog." If the Freeman scale is selected, this selection should be memorized and used.

For measuring quality the Thorndike Handwriting Scale and the Ayres Handwriting Scale, Gettysburg Edition, have probably been used most. Both these scales consist of a series of specimens of handwriting definitely evaluated and arranged in order of difficulty. The specimen under consideration is compared with the specimens on the scale and a value assigned in terms of the values assigned to the specimens thereon. The Freeman scale is probably the best example of an analytical scale. This scale really is composed of five scales, one for each of the following: uniformity of slant, uniformity of alignment, quality of line, letter formation, and spacing. Each of these five subscales is represented by three degrees of quality. The sum of the scores a specimen receives on the subscales gives the handwriting score. This scale is especially valuable for diagnostic purposes.

Individual differences in handwriting. As is true in all other abilities, children who have received approximately the same school training differ widely in handwriting abilities. The scores made on the Ayres scale by the members of several sections of a fifth grade are shown in Table LXIX. An examination of the table shows that some children are superior in writing ability to the norm presented in Table

LXVII, page 417, for children several grades lower. These differences may be accounted for in several ways. Not all the children have the same innate ability and therefore do not learn at the same rate. Neither have all had exactly the same motivation in learning to write. Some pupils learn to take a great deal of pride in their work; others are only interested in finishing the assigned task in such a manner as to get it accepted by the teacher.

Table LXIX. Showing Ayres Quality Scores in Handwriting for a Number of Fifth-Grade Sections

Score	Section			
	1	2	3	4
80	1			
75				1
70	1			3
65	2			2
60	5	1		2
55	4	5	3	7
50	5	5	3	5
45	3	8	4	5
40	8	10	10	3
35	1	2	8	2
30	1	2	5	3
25		1	1	
No. Pupils	31	34	34	33

When scores are tabulated as in Table LXX, the table is generally referred to as a distribution table. In this table a pupil's score is tabulated according to both speed and quality (form). For example, if a pupil has a speed score of 85 and a quality score of 62, his score would be placed opposite the class interval 80–89 and under 60. A further examination of the table shows that there are children who write rapidly and with poor quality, while others write slowly and with poor quality. Of the pupils who write with good quality some write rapidly and some slowly. Almost any combination of speed and quality may be found in the table. The fact that such a wide variety of combinations is found in a grade makes the teacher's problem in teaching handwriting a more difficult one.

Diagnosis and remedial treatment. There is a growing tendency to give more attention to the individual pupil in instruction. In handwriting there is much inefficient teaching due to the fact that all pupils are taught in the same way regardless of their needs. Many teachers, however, recognize the fact that the chief purpose of handwriting instruction is to develop such speed and quality as will facilitate written expression. General instruction in handwriting for all pupils does not meet the wide variety of needs found in the typical classroom. By means of such diagnostic materials as the Leamer Diagnostic Practice Sentences in Handwriting[1] and Freeman's Chart for Diagnosing Faults in Handwriting[2] the individual needs of the pupils may be discovered and individual instruction given accordingly.

---

[1] Leamer, E. W. *Diagnostic Practice Sentences in Handwriting*, Public School Publishing Company. 1924.

[2] Freeman, F. N. *Chart for Diagnosing Faults in Handwriting.* Published by Houghton Mifflin Company. 1914.

TABLE LXX. SHOWING AYRES QUALITY AND RATE SCORES ON HANDWRITING FOR 132 FIFTH-GRADE PUPILS

RATE SCORE	QUALITY SCORE											
	25	30	35	40	45	50	55	60	65	70	75	80
90–99				1			1				1	
80–89			1	2	1		1	1		1		
70–79		2		2	2	1	3	2	1			1
60–69	1	3	1	7	6	5	4	2	1	2		
50–59		2	3	6	7	6	6	1	2	1		
40–49	1	2	5	6	3	4	2	2				
30–39		2	2	5	1	2	2					
20–29			1	2								

NOTE. The scores enclosed by the heavy lines are at norm for the grade. Those in the upper right-hand corner are above norm for both rate and quality. Those in the upper left-hand corner are low in quality and high in speed. While those in the lower left-hand corner are low in both.

The method given in Table LXX for tabulating scores which show each pupil's standing in both rate and quality of handwriting furnishes an excellent way of picturing the conditions in a school system with respect to the handwriting ability of the pupils. In this table the scores for 132 pupils are tabulated so that one may see at a glance the number of pupils who are: (1) at norm, (2) high in rate but poor in quality, (3) high in both rate and quality, (4) high in quality but low in rate, and (5) low in both rate and quality. With a smaller group of children the initials of each child can be entered on the table.

QUESTIONS AND EXERCISES

1. Distinguish between the general and specific aims of handwriting.

2. Name some ways of motivating handwriting. If possible, visit a grade during the writing period. List any methods the teacher uses in providing for individual differences and for motivation.

3. Measure a specimen of your own handwriting by means of a handwriting scale. Do you write better than the average eighth-grade pupil?

4. Name all the elements you can which enter into the writing habit.

5. How did Freeman scientifically study handwriting movements?

6. Plot graphs for the speed and quality averages listed in Table LXVII. In what grade does most improvement take place?

7. Secure specimens of handwriting from a grade as follows: Have the pupils memorize a sentence or short selection. Furnish uniform paper to all the pupils and then ask them to write the sentence or selection as well as they can. Next ask them to write the selection on another sheet of paper as well as they can and as rapidly as they can. Then secure a third specimen of the same selection on still a third sheet of paper, directing that they write as rapidly as possible. Be careful to allow exactly two minutes for each specimen.

8. Score the specimens by means of a handwriting scale, keeping the scores for each set of samples separate.

9. Secure a rate score for each specimen by dividing the number of letters written by 2. This will give a score in terms of the number of letters written per minute.

10. Compare the quality of the samples secured under the three conditions. What is the difference between the median scores for the samples secured under the first and third conditions? How do the median rate scores for the second and third compare?

11. Examine the scores for each specimen of the second set to determine how many of the pupils are above norm, at norm, below norm.

12. When the scores for your material are tabulated, how do they compare with those for a similar grade as listed in Table LXVII.

13. Plot a graph showing the rate and quality scores.

14. If there are any left-handed writers in the grade tested, compare their achievement with that of the right-handed.

15. If you have available intelligence test scores for these children, find the relation between the scores and their writing quality by the method illustrated in Table XVIII, page 88.

16. Score the second set of samples by means of the Freeman scale. Are the medians equal for the five traits scored? Find the trait in which the class is poorest and the one in which it is best, according to the scale.

17. Could you prescribe remedial measures in the light of the test results? How?

SELECTED REFERENCES

1. Freeman, F. N. "The Handwriting Movement," *Supplementary Educational Monographs*, No. 3. University of Chicago. 1918.

2. Freeman, F. N., and Dougherty, Mary L. *How to Teach Handwriting.* Houghton Mifflin Company.
3. Freeman, F. N. *Chart for Diagnosing Faults in Handwriting.* Houghton Mifflin Company.
4. Gilliland, A. R., and Jordan, R. H. *Educational Measurements and the Classroom Teacher*, Chap. VI. The Century Co. 1924.
5. Hertzberg, O. E. "A Comparative Study of Different Methods Used in Teaching Beginners to Write," Teachers College, Columbia University, *Contributions to Education*, No. 214. 1926.
6. Hollingworth, Leta S. *Special Talents and Defects*, Chap. IX. The Macmillan Company. 1923.
7. Monroe, W. S., DeVoss, J. C., and Kelly, F. J. *Educational Tests and Measurements*, Chap. IV. Houghton Mifflin Company. 1924.
8. Paulu, E. M. *Diagnostic Testing and Remedial Teaching*, Chap. VII. D. C. Heath and Company. 1924.
9. Reed, H. B. *Psychology of Elementary School Subjects*, Chap. XIII. Ginn and Company. 1927.
10. Taylor, J. S. *The Supervision and Teaching of Handwriting.* Johnson Publishing Company. 1926.
11. West, Paul V. *Changing Practice in Handwriting Instruction.* Public School Publishing Company. 1927.

CHAPTER XIX

THE PSYCHOLOGY OF ARITHMETIC

Historical. A study of the origin and development of the subject matter of arithmetic will show that number ideas are more abstract and more difficult of formulation than is generally supposed. No one knows exactly how the idea of number arose. The history of the origin of mathematics is lost in antiquity. Probably number concepts developed in primitive society somewhat as they develop in the child during the early years of its life. Naturally, those persons of superior ability discovered better ways of counting and handling quantitative materials. As new ways of treating numerical data were discovered, these were passed on to succeeding generations. Many individuals of many races have contributed to the development of the subject matter of arithmetic.

In studying the history of arithmetic it is found that the Hindus, Arabians, and Egyptians showed an interest in the subject and applied its operations to their business problems. The Greeks manifested a great cultural interest in the study of arithmetic and realized as well its practical value. The Romans were interested in arithmetic because of its utilitarian value. The contributions they made to arithmetic are very small. During the "dark ages" the development of arithmetic was at a standstill;

but with the advent of the Renaissance, a new and wider need was introduced for the subject. The commercial and business life of the time demanded further knowledge. Following the Renaissance, progress in arithmetic was made in several directions: (1) the development of arithmetic in relation to business and commercial needs; (2) the introduction of the common symbols, such as the equality sign in the year 1557, division sign in 1659; (3) the invention of decimal fractions, seventeenth century; (4) invention of logarithms by Napier, 1614; (5) algebraic symbols and their function.[1]

Very little is known concerning the earliest form of counting, but an examination of the number systems of the early civilized nations shows that the systems in use were clumsy and that it was often necessary to introduce mechanical aids in counting. The Arabic number system is universally accepted by the world today. It probably originated in India and was transmitted to Europe through Arabia by traders. At the present time the system dominates all mathematical and scientific forms of thinking. Teachers should recognize that number order and number combinations involve abstract thinking and, that in order to make instruction in arithmetic effective during the earliest stages, a lesson may be derived from the primitive intellectual system of measurement. It appears quite likely that counting was first introduced in the form of a one-to-one relationship. A primitive herder might thus count his cattle by placing a stick or pebble on a pile to represent one of a herd of cattle and noting the total number of cattle possessed by the number of pebbles on the pile. The words "symbol" and "digit" indicate that the fingers were related to early counting. Furthermore, the fact that our counting system is based on groupings of tens lends further support to this contention. The lesson to be learned by the teacher here is that the ability to deal with numerical data in an abstract way grows out of experiences in which the child has handled concrete materials. Numerical symbols, rather than the concrete objects, may, after the child has had sufficient experience with things themselves, be used in thinking.

---

[1] Smith, D. E. *The Teaching of Elementary Mathematics*, pp. 66–68. The Macmillan Company. 1906.

Learning to count as a preparation for later numerical work. The child early begins to acquire ideas of number. In his play with blocks and objects of all kinds he develops a need for and an interest in number. This is later expressed in his attempts to count. The normal child, if given opportunity, will soon learn to count a small number of objects. This ability gained early in life has certain definite values which function later in the acquisition of arithmetical ability. Counting has values which may be listed as follows:

1. Gives the number series in their proper orders.
2. Gives definite names to the different positions in the number series.

3. Gives the decimal system and the repetition that enters into the Arabic system.

4. Prepares for an association of the spoken name with the written symbol.

5. Prepares for the four fundamental operations with which arithmetic is primarily concerned.

Without a knowledge of the names of the numbers and their proper order, the child will be unable to associate the spoken name and its position with the written symbol. The child cannot thus acquire the concepts that are necessary for the acquisition of knowledge relating to the fundamental operations in arithmetic.

The relation of the number concept to the written symbol. After the child has acquired a concept of the number, the next task confronting him is the association of this concept with the written symbol. The symbol "2" associated with the spoken word "two" will be meaningless to the child unless he has already acquired the concept of the spoken word "two." Needless to say, this concept must be acquired through experiences in which the spoken word "two" is constantly and simultaneously associated with two objects. In the early period of training and after the concept of certain numbers has been acquired, the symbol "2" is associated simultaneously with the spoken word "two" and in this manner the child develops a meaning for the symbol.

When should formal instruction be introduced? Educators are not in agreement concerning the time to begin a study of formal number. The results of an investigation by Jessup and Coffman[1] indicate that there is no agreement in practice concerning the grade in which this formal instruction should be introduced. Data as to the grade in which formal number work was begun were secured from 754 cities. This investigation indicated that in one half the cases a textbook is introduced in the fourth grade. Furthermore, it is found that the place of introducing the text varies from the first to the sixth grade, inclusive. Objective tests show that formal number work can be deferred until the end of the third year in the school without placing the student at a disadvantage in relation to the acquisition of skill in the fundamentals. In this connection Taylor[2] conducted an investigation which indicates that time spent on silent reading is of more value than that spent on formal number and that the children trained in silent reading actually surpass those whose time is used for number work. Of course, one must not infer here that counting and small problems are not to be introduced. It appears that counting and other simple number concepts should be introduced in connection with the other activities of the schoolroom. Certainly abstract relations should not be introduced early. Number work can be introduced by means of problems which arise in the schoolroom or in the class procedure. Plays and games are often of great value because they create a need for counting and for other simple number facts. Games can thus be made a means as well as a motivating factor for the acquisition of number concepts.

---

[1] Jessup, W. A., and Coffman, L. D. *The Supervision of Arithmetic.* The Macmillan Company. 1916.

[2] Taylor, J. S. "Omitting Arithmetic in the First Year," *Educational Administration and Supervision*, pp. 87–93. February, 1916.

What are the aims of arithmetic in the elementary school? A subject like arithmetic, which has so long held a prominent place in the curriculum, has developed a series of values to justify itself. These values have changed continually so that the aims of arithmetic teaching at one period may not be the same as those of another. As a result of experimentation dealing with the transfer of training, the extreme view of formal discipline which was so generally held in the past has been modified. As a result of this, arithmetic has lost some of its importance in the curriculum.

The utilitarian value has long served to explain the place of arithmetic in the elementary school curriculum. In recent years the subject matter of arithmetic has constantly been under severe criticism and has been studied in order that the material that is not of use in actual life situations might be further eliminated. As a result of the various investigations as to the essential elements that should be taught in arithmetic, a great many topics have been eliminated while other material has been added in order to meet the economic and social demands of the present day.

The aims of arithmetic may be considered from two points of view. The one has reference to the development of such skills and knowledges as will

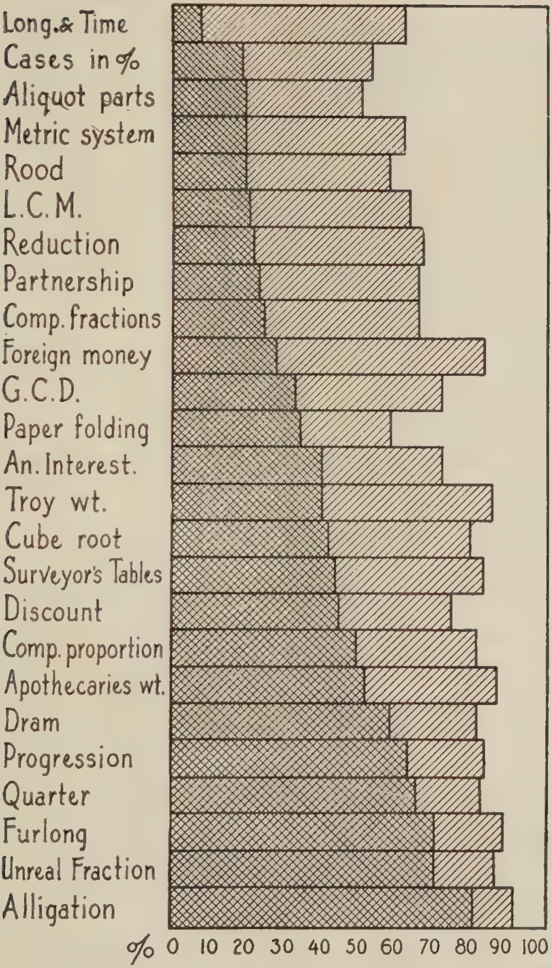


Chart I. — Percentage of superintendents who favor "elimination" or "less attention" (830 cities represented). Checked surface represents the percentage who favor elimination. Shaded surface represents the percentage who favor less attention.

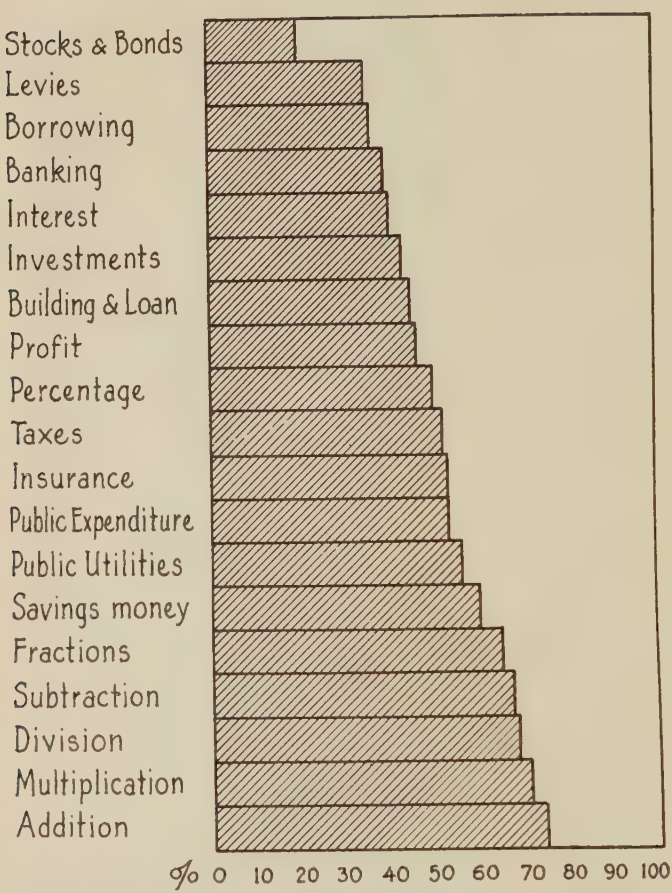


CHART II. — Percentage of superintendents who favor giving more attention to each of these topics (830 cities represented).

be of value in practical situations in life. The other is concerned with the development of such skills and knowledges as will be of aid to the individual in the development of his intellectual life. It is in connection with the realization of such aims that the various studies of the materials needed in arithmetic have been conducted. In the investigation of those most essential in arithmetic, one finds that the investigators have used different methods of attack and have chosen different fields for their studies.

Jessup [1] reports the results of replies from a questionnaire sent out to school superintendents. This questionnaire dealt with the elimination of topics and the place of increased emphasis in arithmetic. Replies were received from eight hundred and thirty city superintendents. Charts I and II give the results from this study. Chart I deals with the topics that the superintendents favor eliminating. Chart II shows the topics superintendents favor giving more attention. These charts are taken from the report given by Jessup.

As a result of the findings of this investigation Jessup [2] concludes:

> In view of the fact that such a large percentage of the superintendents of the country have already either elimi-

---

[1] Jessup, W. A. "Current Practices and Standards in Arithmetic, Minimum Essentials in Elementary School Subjects. Standards and Current Practices," *The Fourteenth Yearbook of the National Society for the Study of Education*, Part I, pp. 116–130.

[2] *Ibid.*, p. 118.

nated these topics or are in favor of giving them less attention, it is recommended that an economy of time may be effected by the elimination of the following topics from the elementary course of study: apothecaries' weight, alligation, aliquot parts, annual interest, cube root, cases in percentage, compound and complex fractions of more than two digits, compound proportion, dram, foreign money, folding paper, the long method of greatest common divisor, longitude and time, least common multiple, metric system, progression, quarter in avoirdupois table, reduction of more than two steps, troy weight, true discount, unreal fractions.

Wilson[1] and Wise[2] conducted independently studies in which they had school children collect the examples used by their parents in their daily activities. Both these studies are very practical in their implications, and their results point to the same general conclusions. Most of the examples reported involved only the four fundamentals. When fractions were used both studies show that $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{2}{3}$, and $\frac{1}{5}$ constituted most of the fractions. Very few problems were found which dealt with such topics as board measure, compound interest, carpeting, proportion, roofing, shingling, square measure, foreign exchange, apothecaries' weight, compound and complex fractions, paper folding, linear measure, painting, hay in stack, cord of wood, troy weight, or the metric system. These studies suggest that more emphasis should be placed on the fundamentals and the simple problems that are encountered in daily life. Smith [1] reports an investigation made in connection with the arithmetic used by elementary school children in their activities outside of the school. These activities consisted primarily of counting, together with short exercises involving the four fundamentals. The four fundamental operations were needed in most cases in the play activities such as games, playing store, and banking.

---

[1] Wilson, G. M. "A Survey of the Social and Business Use of Arithmetic," "Second Report of the Committee on Minimal Essentials in Elementary School Subjects," *The Sixteenth Yearbook of the National Society for the Study of Education*, Part I.

[2] Wise, Carl T. "A Survey of Arithmetical Problems Arising in Various Occupations," *The Elementary School Journal*, Vol. XX, pp. 118–136. 1919.

The studies here listed, together with those conducted by Mitchell,[2] Moore,[3] Woody,[4] and others, indicate that what is needed most in arithmetic is more emphasis on the four fundamentals. Each of these studies considered arithmetic from the utilitarian viewpoint and therefore the essentials are stated in accordance with this view.

What is the function to be developed? The function to be developed in the study of arithmetic is a conception of numerical relation and the ability to use this conception in life situations. The child very early acquires concepts of numerical relations. These are usually expressed in units that are unstandardized as "more" or "less," "much" or "little," etc. Number cannot be thought of as a sense fact; but as an idea resulting from the experiences of the child. The acquisition of the concept of number is a gradual process. A child fairly early learns to distinguish between one object and two objects; but the distinction between four objects and five objects is not so simple, and is not made by the child so early. Counting is sometimes carried on quite early by him; but he is not always able to apply the number names to a great number of objects. The process of applying number names to objects is not a concrete process; but rather an abstract one. In the case of number names in counting, a series of names stands for a series of objects. However, the same names may be applied to different things, as: books, sticks, playmates, or other materials wholly unrelated to the number names or to one another. In each case there is one name for each object counted and, as more objects are introduced into the series, more number names are used, but the same number name is not confined to one kind of object.

---

[1] Smith, Nila B. "An Investigation of the Uses of Arithmetic in the Out-of-School Life of First-Grade Children," *The Elementary School Journal*, Vol. XXIV, pp. 621-626. 1924.

[2] Mitchell, H. E. "Some Social Demands on the Course of Study in Arithmetic," "Third Report of the Committee on Economy of Time in Education," *The Seventeenth Yearbook of the National Society for the Study of Education*, Part I, pp. 7–17.

[3] Moore, E. C. *Minimum Course of Study*, pp. 1–41. The Macmillan Company. 1922.

[4] Woody, Clifford. "Salesmanship," *The Elementary School Journal*, Vol. XXII, pp. 505–520. 1922.

Upon what factors does ability in arithmetic depend? It is important that we know the relation between the various factors conditioning successful work in arithmetic and the importance of each. Thorndike[1] summarized the findings concerning the interrelation of abilities as they apply to arithmetic. He states:

> Achievement in arithmetic depends upon a number of different abilities. For example, accuracy in copying numbers depends upon eyesight, ability to perceive visual details, and short-term memory for these. Long column addition depends chiefly upon great strength of the addition combinations especially in higher decades, "carrying," and keeping one's place in the column. The solution of problems framed in words requires understanding of language, the analysis of the situation described into its elements, the selection of the right elements for use at each step and their use in the right relations.

In an investigation made at the University of Iowa, Huffaker[2] attempted to determine the importance of some of the factors as they condition learning in arithmetic. He studied the performance of 66 pupils in the University Experimental School by means of a large number of tests. He then analyzed his test results. His conclusions are given below.

1. The chief conditioning factors in general arithmetical ability are: first, attitude; second, mental age; third, chronological age. He found the relative importance of these factors to be approximately as follows: attitude, 2.8; mental age, 1.76; chronological age, 1.00.

---

[1] Thorndike, E. L. *The Psychology of Arithmetic*, Chap. XIV, p. 295. 1922. By permission of The Macmillan Company, publishers.

[2] Huffaker, C. L. "Psychological Analysis of Learning in Arithmetic," *Ph.D. Thesis, unpublished*, p. 5. University of Iowa.

2. The chief conditioning factors in the ability to solve problems stated in words are: first, computation; second, mental age; third, chronological age. The relative value of these factors were found to be: computation, 3.96; mental age, 1.99; chronological age, 1.00.
3. The chief factors which condition the ability to solve exercises in computation are: first, attitude; second, mental age; third, chronological age. The relative importance of these factors was found to be approximately: attitude, 3.56; mental age, 1.16; chronological age, 1.00.

Case studies were made of many of these pupils. When a pupil was found whose achievement varied widely from his general educational achievement, the tendency was for him to score high in attitude in case he scored higher in arithmetic than in the other school subjects. The tendency was for him to score low in attitude in arithmetic in case he scored lower in arithmetic than in the other subjects.

Motivation in arithmetic. Arithmetic makes little or no appeal to the collecting tendency, to muscular manipulation, to sensory curiosity, or to the child's original interest in things and their mechanisms, and people and their behavior patterns, but it is fairly well liked by children. The reason for this lies probably in the strength of its appeal to the interest of the child in definite achievement, success, doing what one attempts to do, and, in grades five to eight, to the practical interest of getting along in the world. Arithmetic, more than any other subject in the elementary school, permits the pupil to see his own progress and determine his own success or failure.

The strongest appeal to the pupil is based on the development of a full conviction that what he is to learn is necessary and useful in his life. It will not suffice merely to justify the lessons in an artificial way. Once social worth is shown, we can reasonably assure ourselves that the child will be actuated by a real motive, that attention will be cheerfully given, that interest of a really dynamic nature will be aroused. New experiences can be related to the subject at hand. No other subject yields so well to a treatment in which interest can be aroused through games, competition, and other social activities. The activities involved in arithmetic can be referred to problems in connection with any of the interests of the child. Even puzzle solving is often arrived at through some process in arithmetic. Any healthy means to give further interest and better stimulation to the child's activities related to arithmetic problems should eagerly be sought and cherished.

Formation of habits. James[1] lays down, as one of the first principles in habit formation, that the pupil should have a clear understanding of the habit to be formed. In arithmetic, more than in any other subject in the elementary school curriculum, correct habit formation is important. Every item in the subject matter as a whole, every item in the multiplication table, the simple addition combinations and the reverse processes, the simpler tables of weights and measures — all these and similar items

---

[1] James, William. *Psychology, Briefer Course,* Chap. X. Henry Holt and Company. 1910.

— must be developed into habit. Also, there are the habits of procedure upon which all quantitative knowledge is based. In order that computation can be easily and quickly understood, there are specific processes which are performed in certain ways and definite mechanical placings of figures that are very important.

What drills are needed? It appears to be a sound assumption that all persons should be skilled in addition, subtraction, multiplication, and division. In order that the individual may be skilled in these processes, it is necessary to have a certain amount of correct practice. Correct practice in these four processes is essential to insure the development of the proper habits of accuracy, speed, and application. It is needless to state that the amount of practice necessary to establish habits varies directly with the difficulty of the habits to be established and the ability of the student. However, very few drills take into account the difficulty of the different exercises. In fact, it has only been within recent years that there has been any scientific evidence concerning the relative difficulty of the integral processes. Phelps[1] (1913), Holloway[2] (1917), Clapp[3]

---

[1] Phelps, C. L. "A Study of Errors in Tests of Adding Ability," *Elementary School Teacher*, Vol. 14, pp. 29–39. 1913.

[2] Holloway, H. V. "Experimental Study to Determine the Relative Difficulty of the Elementary Number Combinations in Addition and Multiplication," *University of Pennsylvania Studies in Education*. 1917.

[3] Clapp, F. L. "The Number Combinations: Their Relative Difficulty and the Frequency of Their Appearance in Text-Books,"

IX

(1924), and ReBarker[1] (1926) conducted investigations in which the relative difficulty of the number combinations of the fundamental processes was studied and determined scientifically. These investigators attacked the problem by studying the errors made in the fundamental processes by grade children. This method assumes that the probability of error in a given process is an index of the difficulty of the combination.

Other investigators have used the length of reaction time taken to perform certain combinations as an index of the difficulty. Smith, Heilman, and Shultis have used this method. The results from all these investigations are reviewed and presented in tabular form by ReBarker in his investigation conducted at George Peabody College for Teachers. Tables LXXI, LXXII, LXXIII, and LXXIV give the order of difficulty of the combinations as found by Clapp and ReBarker. Clapp's investigation is based on errors made by 7000 children from grades four to eight, inclusive. ReBarker's investigation is based on results from 4000 children from grades five to eight, inclusive (1000 from each grade).

He expresses the relative difficulty in standard deviation units. By thus giving the difficulty in standard deviation units, it is assumed that the errors

---

Bureau of Education Research Bulletin, No. 2. University of Wisconsin. 1924.

[1] ReBarker, Herbert. "A Study of the Simple Integral Processes of Arithmetic," George Peabody College for Teachers, *Contributions to Education,* No. 26. 1926.

Table LXXI. Showing the Order of Difficulty, from Greatest to Least, for the Addition Combinations as Found by ReBarker and Clapp

ReBarker	Clapp	ReBarker	Clapp	ReBarker	Clapp
8 + 3	8 + 5	5 + 7	3 + 5	1 + 4	6 + 4
9 + 6	7 + 9	7 + 4	6 + 3	2 + 5	1 + 4
9 + 3	5 + 8	8 + 0	7 + 3	3 + 4	9 + 1
9 + 7	9 + 7	9 + 0	2 + 7	3 + 6	5 + 0
8 + 5	6 + 8	2 + 8	8 + 4	5 + 2	6 + 6
8 + 9	6 + 9	7 + 0	4 + 8	6 + 3	3 + 2
4 + 6	5 + 7	7 + 6	8 + 0	8 + 1	4 + 3
4 + 9	7 + 8	3 + 9	1 + 0	8 + 8	1 + 5
5 + 9	8 + 7	6 + 7	5 + 2	0 + 1	7 + 1
7 + 8	9 + 6	2 + 6	4 + 2	0 + 4	2 + 9
7 + 9	5 + 9	5 + 3	1 + 2	0 + 7	2 + 5
9 + 8	8 + 9	6 + 2	5 + 3	0 + 9	2 + 8
6 + 8	8 + 6	6 + 4	0 + 3	1 + 7	4 + 4
6 + 9	4 + 7	1 + 3	0 + 5	2 + 1	4 + 1
1 + 0	7 + 5	1 + 6	5 + 1	2 + 3	3 + 1
3 + 1	4 + 9	1 + 9	7 + 0	3 + 2	4 + 0
5 + 8	9 + 5	2 + 4	8 + 7	9 + 2	1 + 8
3 + 3	9 + 4	3 + 5	0 + 1	0 + 5	9 + 9
4 + 7	6 + 7	5 + 0	7 + 2	1 + 8	7 + 7
8 + 6	5 + 6	5 + 6	1 + 9	2 + 2	2 + 0
8 + 7	4 + 6	7 + 2	0 + 5	2 + 9	6 + 1
9 + 4	7 + 6	8 + 2	8 + 1	5 + 4	5 + 4
9 + 5	7 + 4	3 + 8	6 + 2	5 + 5	3 + 3
1 + 5	9 + 8	4 + 1	0 + 4	6 + 1	1 + 1
6 + 0	3 + 7	4 + 2	3 + 6	6 + 6	9 + 2
8 + 4	9 + 0	4 + 3	0 + 2	7 + 7	8 + 8
4 + 0	2 + 6	5 + 1	2 + 4	9 + 9	1 + 3
4 + 8	9 + 3	6 + 5	3 + 0	1 + 1	1 + 6
7 + 3	0 + 6	9 + 1	4 + 5	1 + 2	1 + 7
7 + 5	6 + 5	0 + 2	0 + 8	4 + 4	2 + 1
2 + 0	3 + 8	0 + 3	6 + 0	4 + 5	2 + 2
2 + 7	3 + 4	0 + 6	8 + 3	7 + 1	5 + 5
3 + 0	3 + 9	0 + 8	8 + 2	0 + 0	0 + 0
3 + 7	2 + 3				

TABLE LXXII. SHOWING THE ORDER OF DIFFICULTY, FROM GREATEST TO LEAST, FOR THE SUBTRACTION COMBINATIONS AS FOUND BY REBARKER AND CLAPP

REBARKER	CLAPP	REBARKER	CLAPP	REBARKER	CLAPP
16 – 9	14 – 9	5 – 0	14 – 7	5 – 1	10 – 2
15 – 9	13 – 4	9 – 0	12 – 4	8 – 1	7 – 6
15 – 6	16 – 9	4 – 0	10 – 8	2 – 2	9 – 5
11 – 3	14 – 5	10 – 7	7 – 4	6 – 6	8 – 7
15 – 8	17 – 9	3 – 2	12 – 8	10 – 9	4 – 1
14 – 6	15 – 9	5 – 2	1 – 0	4 – 2	2 – 2
11 – 4	17 – 8	9 – 2	8 – 3	6 – 2	7 – 5
13 – 4	15 – 7	3 – 0	7 – 0	9 – 4	6 – 4
13 – 5	13 – 9	4 – 1	12 – 9	8 – 6	6 – 1
16 – 7	13 – 5	8 – 3	10 – 5	12 – 6	2 – 1
11 – 8	16 – 7	12 – 7	10 – 6	7 – 7	5 – 2
14 – 5	13 – 7	12 – 8	8 – 0	14 – 7	6 – 3
13 – 8	13 – 8	8 – 2	2 – 0	2 – 1	3 – 1
14 – 9	11 – 3	11 – 2	9 – 7	6 – 4	7 – 1
12 – 4	14 – 6	11 – 6	9 – 4	8 – 5	4 – 3
15 – 7	12 – 3	9 – 7	4 – 0	10 – 8	5 – 5
17 – 9	15 – 6	12 – 9	3 – 0	9 – 1	8 – 4
13 – 9	14 – 8	18 – 9	5 – 0	3 – 3	6 – 5
13 – 7	12 – 5	1 – 1	9 – 6	5 – 5	9 – 8
14 – 8	12 – 7	3 – 1	8 – 2	7 – 2	4 – 4
8 – 0	11 – 4	6 – 1	10 – 4	8 – 4	9 – 1
11 – 5	11 – 6	10 – 2	8 – 8	7 – 5	9 – 9
17 – 8	16 – 8	6 – 3	9 – 3	10 – 5	5 – 3
11 – 9	18 – 9	7 – 3	7 – 3	9 – 6	5 – 4
1 – 0	11 – 9	10 – 6	6 – 0	9 – 9	1 – 1
6 – 0	11 – 7	8 – 8	9 – 0	5 – 4	8 – 1
9 – 3	13 – 6	16 – 8	7 – 2	6 – 5	4 – 2
10 – 3	15 – 8	7 – 1	12 – 6	10 – 1	6 – 6
12 – 3	8 – 5	4 – 3	10 – 7	5 – 3	3 – 3
11 – 7	11 – 5	4 – 4	8 – 6	7 – 6	3 – 2
2 – 0	11 – 8	7 – 4	11 – 2	8 – 7	7 – 7
7 – 0	9 – 2	10 – 4	10 – 1	9 – 8	5 – 1
12 – 5	10 – 3	9 – 5	6 – 2	0 – 0	0 – 0
13 – 6	10 – 9				

Table LXXIII. Showing the Order of Difficulty, from Greatest to Least, for the Multiplication Combinations as Found by ReBarker and Clapp

ReBarker	Clapp	ReBarker	Clapp	ReBarker	Clapp
0 × 9	7 × 0	9 × 3	8 × 5	7 × 5	3 × 5
0 × 2	0 × 5	4 × 9	8 × 4	1 × 6	8 × 1
0 × 6	0 × 7	7 × 6	9 × 8	2 × 8	1 × 9
0 × 8	0 × 1	8 × 6	9 × 3	3 × 1	4 × 3
0 × 1	4 × 0	6 × 7	5 × 6	3 × 4	5 × 5
0 × 3	0 × 8	4 × 7	6 × 7	4 × 5	3 × 3
0 × 7	0 × 2	3 × 9	4 × 8	8 × 2	9 × 1
0 × 4	0 × 4	8 × 5	3 × 8	1 × 9	7 × 2
0 × 5	2 × 0	8 × 4	4 × 6	4 × 6	2 × 7
1 × 0	0 × 6	3 × 3	5 × 8	5 × 1	2 × 3
5 × 0	9 × 0	4 × 8	3 × 9	5 × 3	4 × 1
7 × 0	8 × 0	3 × 8	7 × 7	5 × 7	4 × 4
3 × 0	0 × 3	4 × 4	3 × 7	6 × 5	5 × 2
2 × 0	6 × 0	5 × 9	5 × 7	7 × 2	7 × 1
4 × 0	0 × 9	2 × 3	5 × 9	1 × 2	8 × 2
9 × 0	3 × 0	5 × 8	9 × 5	1 × 5	3 × 2
8 × 0	9 × 7	7 × 3	7 × 3	1 × 7	3 × 1
6 × 0	5 × 0	9 × 5	9 × 9	8 × 1	6 × 1
9 × 7	1 × 0	4 × 3	7 × 5	9 × 2	1 × 8
7 × 9	8 × 7	5 × 4	4 × 5	3 × 5	5 × 4
7 × 7	9 × 6	7 × 4	3 × 4	3 × 7	2 × 9
8 × 8	6 × 9	6 × 2	2 × 4	6 × 1	2 × 1
6 × 9	7 × 9	2 × 6	4 × 2	1 × 8	1 × 6
7 × 8	7 × 8	3 × 2	5 × 3	2 × 1	1 × 5
8 × 7	6 × 8	6 × 3	6 × 6	2 × 7	2 × 2
1 × 1	8 × 6	1 × 3	6 × 3	2 × 9	9 × 2
9 × 6	4 × 9	3 × 6	6 × 4	4 × 1	2 × 8
8 × 9	4 × 7	1 × 4	1 × 2	2 × 5	1 × 4
5 × 5	1 × 1	2 × 4	6 × 5	7 × 1	2 × 5
9 × 8	8 × 9	4 × 2	2 × 6	9 × 1	1 × 3
6 × 6	9 × 4	8 × 3	3 × 6	2 × 2	5 × 1
9 × 9	7 × 4	6 × 4	8 × 3	0 × 0	1 × 7
6 × 8	7 × 6	5 × 6	6 × 2	5 × 2	0 × 0
9 × 4	8 × 8				

Table LXXIV. Showing the Order of Difficulty, from Greatest to Least, for the Division Combinations as Found by ReBarker and Clapp

ReBarker	Clapp	ReBarker	Clapp	ReBarker	Clapp
2 ÷ 1	2 ÷ 2	2 ÷ 2	0 ÷ 2	0 ÷ 7	21 ÷ 3
54 ÷ 9	9 ÷ 9	7 ÷ 1	0 ÷ 7	6 ÷ 2	30 ÷ 5
54 ÷ 6	28 ÷ 4	3 ÷ 3	0 ÷ 8	16 ÷ 8	12 ÷ 3
48 ÷ 6	1 ÷ 1	8 ÷ 1	8 ÷ 1	12 ÷ 4	15 ÷ 5
28 ÷ 4	36 ÷ 4	9 ÷ 1	45 ÷ 5	28 ÷ 7	12 ÷ 6
56 ÷ 7	8 ÷ 8	6 ÷ 1	42 ÷ 6	27 ÷ 9	36 ÷ 6
64 ÷ 8	3 ÷ 3	4 ÷ 4	18 ÷ 9	10 ÷ 2	16 ÷ 2
63 ÷ 7	6 ÷ 6	18 ÷ 2	16 ÷ 8	21 ÷ 3	14 ÷ 7
36 ÷ 4	56 ÷ 8	40 ÷ 8	4 ÷ 1	40 ÷ 5	24 ÷ 8
27 ÷ 3	54 ÷ 6	0 ÷ 1	20 ÷ 4	30 ÷ 6	48 ÷ 6
42 ÷ 6	9 ÷ 1	45 ÷ 9	6 ÷ 1	16 ÷ 4	24 ÷ 4
42 ÷ 7	24 ÷ 6	45 ÷ 5	32 ÷ 8	20 ÷ 4	2 ÷ 1
63 ÷ 9	0 ÷ 1	18 ÷ 3	35 ÷ 5	30 ÷ 5	49 ÷ 7
1 ÷ 1	6 ÷ 3	0 ÷ 5	27 ÷ 9	0 ÷ 9	40 ÷ 8
48 ÷ 8	32 ÷ 4	24 ÷ 6	5 ÷ 1	16 ÷ 2	72 ÷ 8
72 ÷ 8	18 ÷ 2	32 ÷ 8	0 ÷ 3	10 ÷ 5	18 ÷ 6
5 ÷ 1	8 ÷ 4	9 ÷ 9	64 ÷ 8	15 ÷ 5	24 ÷ 3
24 ÷ 3	56 ÷ 7	81 ÷ 9	48 ÷ 8	12 ÷ 6	72 ÷ 9
3 ÷ 1	45 ÷ 9	36 ÷ 6	0 ÷ 4	8 ÷ 2	20 ÷ 5
32 ÷ 4	30 ÷ 6	35 ÷ 7	0 ÷ 6	12 ÷ 2	8 ÷ 2
5 ÷ 5	3 ÷ 1	0 ÷ 2	42 ÷ 7	6 ÷ 3	12 ÷ 2
4 ÷ 1	35 ÷ 7	0 ÷ 4	36 ÷ 9	9 ÷ 3	15 ÷ 3
14 ÷ 7	18 ÷ 3	15 ÷ 3	28 ÷ 7	12 ÷ 3	14 ÷ 2
56 ÷ 8	7 ÷ 7	0 ÷ 8	63 ÷ 7	7 ÷ 7	10 ÷ 5
36 ÷ 9	5 ÷ 5	18 ÷ 9	27 ÷ 3	21 ÷ 7	6 ÷ 2
8 ÷ 8	4 ÷ 4	6 ÷ 6	16 ÷ 4	20 ÷ 5	81 ÷ 9
24 ÷ 4	63 ÷ 9	0 ÷ 3	7 ÷ 1	14 ÷ 2	9 ÷ 3
24 ÷ 8	0 ÷ 5	18 ÷ 6	12 ÷ 4	4 ÷ 2	10 ÷ 2
35 ÷ 5	0 ÷ 9	72 ÷ 9	40 ÷ 5	8 ÷ 4	25 ÷ 5
49 ÷ 7	54 ÷ 9	0 ÷ 6	21 ÷ 7	25 ÷ 5	4 ÷ 2

will fall into a normal frequency distribution, rather than a rectangular distribution, as is assumed by giving results in terms of "per cent of error." The assumption made by ReBarker is one commonly made in scale construction.

Drill on the fundamentals as a part of the recitation. J. C. Brown[1] conducted two thorough investigations in which he made a comparative study of the value of using part of the class period for drill as opposed to the ordinary routine procedure. In each experiment the children were divided into two groups, of equal ability as determined by results from the Stone Arithmetic Tests. The total number of pupils thus placed in the drill section was 25, in the non-drill section 26. After each grade had been divided, teachers of as nearly equal teaching ability as were available were placed in charge of each section. The two sections of a given grade recited at the same time each day and the recitation periods were of the same length, covering the same amount of subject matter in the textbook. The only variable factor was that of drill. In the drill section the first five minutes of each recitation was devoted to drill work in addition, subtraction, multiplication, and division. About one half of this drill work was written and the other half oral. The other section of the grade was given no drill work. This first experiment was carried out on pupils of the sixth, seventh, and eighth grades. The practice was continued for thirty recitation periods when a second test was given. The object of the second test was to determine the effect of the five-minute period of drill in the fundamentals. The second experiment was similar to the first, both in purpose and procedure. In the second experiment 222 children were used and the drill was given for twenty periods.

---

[1] Brown, J. C. "An Investigation on the Value of Drill Work in the Fundamental Operations of Arithmetic," *Journal of Educational Psychology*, Vol. II, pp. 81–88, 1911; Vol. III, pp. 485–492, 561–570, 1912.

In both experiments it was found beneficial to have the daily lesson in arithmetic preceded by a drill period on the fundamental number facts. In the first experiment the drill section increased its speed by a much larger per cent than the non-drill section. The greatest increase was made by the sixth grade (35 per cent); the seventh grade came next (20 per cent); and the least gain was made by the eighth grade (13.8 per cent). In the second experiment the drill section showed an improvement of about two and one-half times as much as the non-drill section. In order to determine whether the gain in the fundamentals, due to the drill work, was offset by a loss in the reasoning ability, a test in reasoning was given. The drill section did 6.3 per cent better than its own previous record in reasoning and the non-drill section made an improvement of but 3 per cent on its previous record. In general, a high correlation has not been found between ability in the fundamentals and ability in problems involving reasoning in arithmetic. Likewise, very little transfer from one arithmetical process to another has been noted. Thus the superiority in improvement actually found in reasoning for the drill section indicates that the five minutes of drill at the beginning of the recitation had an effect on the remaining part. This appeared to place the student in an attitude, a state of readiness, or a mental set that had a positive influence on the recitation.

In order to determine whether the superiority secured in the five-minute drill exercises was transient or not, Brown tested the two sections a third time after a vacation of twelve weeks. No formal school work was done by any of the pupils during the period. The drill section did better on the third test in everything except in addition and in total score. In these the records were much better than in the first test. The non-drill section either did worse or made no improvement in comparison to the second test in everything except in subtraction. Thus the results here show drill to be superior with respect to the permanency of the effects.

Buswell and Judd[1] reviewed studies made by Phillips, Wimmer, and Kerr in which each of the studies shows that drill makes for substantive gain. In all the experiments here referred to, the drill periods were comparatively short. It cannot be inferred from this that doubling the length of drill period would double the gain in achievement.

---

[1] Buswell, G. T., and Judd, C. H. "Summary of Investigations Relating to Arithmetic," *Supplementary Educational Monographs,* No. 27. 1925.

These experiments on drill show the value of drill in increasing efficiency. Drill in arithmetic can be justified, even though the gains from its use may not be so great as are represented in the experiments cited.

Conditions of drill. After the teacher finds out what drills are needed and that drill, as a part of the recitation is effective, her next problem is: What are the combinations of drill that will give the best results? In an answer to this question Buswell and Judd [1] have reviewed the experimental studies on the various conditions of drill under four headings: "(1) the various kinds of drill, (2) the effect of the distribution of drill periods, (3) the effect of rest and vacation periods, and (4) the effect of initial ability on the improvement made through drill."

1. The various kinds of drill. If a teacher is going to employ drill, it is of the utmost importance that the best method of drill be used. Kirkpatrick [2] investigated drill in connection with memorizing multiplication combinations. He made a comparison of the traditional method of memorizing the multiplication table as opposed to the incidental method of learning the combinations from a key sheet, also the method of learning the multiplication combinations through the application of the processes in actual practice. He found that memory

---

[1] Buswell and Judd. *Op. cit.*, Chap. VI.

[2] Kirkpatrick, E. A. "An Experiment in Memorizing Versus Incidental Learning," *Journal of Educational Psychology*, Vol. V, pp. 405–412.

plus practice was the best method, while memorizing the table according to the traditional method was the poorest. These results are of interest because of the wide use that is made of the method of memorizing in exact order the combinations of the multiplication tables.

Wimmer [1] made a comparative study of the effect of drilling for speed and drilling for accuracy. This experiment was conducted in connection with grades five to eight, inclusive. Table LXXV shows the results from his investigation. He concluded that drilling for speed, in general, is superior to drilling for accuracy.

TABLE LXXV. COMPARISON BETWEEN DRILL FOR SPEED AND DRILL FOR ACCURACY

	GRADE 6E (Drilled for Speed)	GRADE 6W (Drilled for Accuracy)	DIFFERENCE IN FAVOR OF SPEED
All tests	11.1	8.8	2.3
Fundamentals	12.9	6.9	6.0
Reasoning, rights only .	11.9	10.6	1.3

2. Distribution of practice in the simple arithmetic processes. The theory dealing with a proper distribution of drill on the number combinations assumes that all combinations should be practiced but that combinations which are inherently most

---

[1] Wimmer, Herman. "Experimental Study of the Effects of Drill in Arithmetical Processes under Varying Conditions," *Indiana University Studies*, pp. 96–102. 1916.

difficult should be practiced most. Knight[1] gives the results from an investigation conducted by Luse at the University of Iowa in which the general problem of distributed and non-distributed drill was studied. Luse used six hundred fifth-grade pupils equally divided into parallel groups on the basis of general arithmetical ability. One group was given drill material carefully constructed as to the distribution of practice material in the four fundamental operations.[2] The other group used material that was not so carefully constructed as to the distribution of practice in the operations; certain combinations were actually slighted. Experienced teachers on the average did not show preference for either type of drill materials. The two groups were then given fifty consecutive fifteen-minute periods of drill. Luse conducted her experiment under well-controlled conditions. All factors were controlled except the distribution of drill on the different operations. After the fifty consecutive drill periods, each group was given a series of tests — one series a few days after the drill periods and another three months later. The findings from this study which seem the most pertinent here are:

1. The gain from the distributed drill was 20 per cent to 54 per cent in the number of combinations attempted, and 31 per cent to 85 per cent in the number of combinations

---

[1] Knight, F. B. *Third Yearbook of the Department of Superintendence of the National Education Association*, pp. 39–40. June, 1926.

[2] Luse, Eva M. "Transfer within Narrow Mental Functions," A Study of the Effects of Distributed versus Non-Distributed Drill in Arithmetic. *University of Iowa Monographs in Education*, No. 5.

correctly answered. The gain from the haphazard type of drill was from 11 per cent to 40 per cent in attempted combinations and from 13 per cent to 61 per cent in combinations correct.

2. The distributed drill gave an excess over the non-distributed drill in examples solved correctly. Gains attributed to distribution of practice are:

Addition	18
Subtraction	19
Multiplication	35
Division	24

3. The same relative differences in gain from the distributed and non-distributed drill held for the different levels of ability as for the whole group.

4. The permanent gain, namely, the gain held during the summer vacation, a period of no practice, in actual number of examples was greater for the group having distributed drill.

5. In the comparisons made there were 126 opportunities for either form of drill to yield results higher, equal, or lower than the other form of drill. The distributed drill excelled in 120 and the non-distributed in 6 of these opportunities. Of the 120 in which the distributed drill excelled 75 showed statistically significant differences, that is, the differences of the means varied from 3 to 12.9 times the probable error of the difference. Of the 6 cases in which the non-distributed drill excelled, no one of the differences was statistically significant.

Reed[1] conducted an experiment with first- and second-year college students working one hour on adding examples of five two-place numbers having no zeros. The subjects were divided into four groups. Group 1 worked for one hour continuously, group 2 twenty minutes a day for three days, group 3 ten minutes a day for six days, group 4 ten minutes a day twice a week for three weeks. Time was marked by each group every ten minutes. Results show that the twenty-minute period was the most effective.

---

[1] Reed, H. B. "Distributed Practice in Addition," *Journal of Educational Psychology*, Vol. XV, pp. 248–249. 1924.

Although experimental evidence is not wholly in agreement concerning the optimum distribution of practice, the teacher must ever bear one important principle in mind: that the element of fatigue will serve to reduce efficiency. When pupils become fatigued, as will be the case in longer practice periods, efficiency will be reduced. In most cases studies in other fields have shown distributed practice to be more effective. This is especially important in connection with reviews. Distributed practice or reviews with the interval slightly increased each time between reviews appears to be the soundest principle to follow. In the light of present scientific evidence this is probably the best procedure.

3. The effect of rest and vacation periods. The experimental results of the study conducted by Brown[1] have already been referred to in connection with the effect of rest and vacation on test results. Brown found that the effect of drill persisted after a period of twelve weeks. The non-drill class either did worse or showed no improvement after a period of twelve weeks. The pupils of the drill class main-

---

[1] Brown, J. C. *Op. cit.*

tained their superiority at the end of twelve weeks. Kirby[1] made a study of the effects of drill when the intervals were varied. He found that there was a slight gain during an interval of twelve days, but during an interval of twelve weeks there was a loss. It has been found that the loss from shorter intervals is not so great as from longer intervals. Furthermore, the effects of drill show rather clearly at the end of the interval or vacation period. The loss, because of the vacation period, is regained in a short time when the periods are short; but when the periods are longer it takes a fairly long time to regain this loss.

4. The effect of initial ability. Students with high initial ability in arithmetic usually make the greatest progress. The effect of practice, or drill, is the greatest for these. Phillips[2] concludes from a study of the relation of initial ability to the extent of improvement in certain mathematical traits that the pupils with high initial ability profit only from drill that is intense in character. Intense drill is superior for the pupils with high initial ability, while drill which is of the ordinary class-work type is almost valueless for the group with high initial ability. A question that is of primary importance to the teacher in the elementary grades is the proportion of class time that should be given to drill. A cer-

---

[1] Kirby, T. J. "Practice in the Case of School Children," Teachers College, Columbia University, *Contributions to Education*, No. 58. 1913.

[2] Phillips, F. M. "Relation of Initial Ability to the Extent of Improvement in Certain Mathematical Traits." *Pedagogical Seminary*, No. 26, pp. 330–335. 1919.

tain amount of intense "snappy" drill at the beginning of the recitation has been found of value. But this drill period has an optimum time. The teacher must not tire the pupils with drill, must not let it drift along, or fall into routine activity.

QUESTIONS AND EXERCISES

1. List the aims of arithmetic in the elementary school. Consult a course of study and see how the list you have made compares with that given there.
2. Discuss the value of the materials of arithmetic as an aid in thinking.
3. List the factors upon which ability in arithmetic depends.
4. List all the methods you have observed teachers use in motivating pupils in their work in arithmetic. Which methods do you consider superior? Which inferior?
5. What is the value of such studies as ReBarker's and Clapp's? Would their findings have any value for the teacher who is arranging drills?
6. State Brown's method of investigating the value of drill work. What did he find? Does this experiment have any practical value?

SELECTED REFERENCES

1. Buswell, G. T. "Diagnostic Studies in Arithmetic," *Supplementary Educational Monographs*, No. 30. July, 1926.
2. Buswell, G. T., and Judd, C. H. "Summary of Investigations Relating to Arithmetic," *Supplementary Educational Monographs*, No. 27. 1925.
3. Clapp, F. L. "The Number Combinations: Their Relative Difficulty and the Frequency of Their

Appearance in Text Books," *Bureau of Education Research Bulletin*, No. 2, University of Wisconsin. 1924.

4. JESSUP, W. A., and COFFMAN, L. D. *The Supervision of Arithmetic*. The Macmillan Company. 1916.
5. JUDD, C. H. "Psychological Analysis of the Fundamentals of Arithmetic," *Supplementary Educational Monographs*, No. 32. February, 1927.
6. LENNES, N. J. *The Teaching of Arithmetic*, Chaps. I, II, and V. The Macmillan Company. 1924.
7. MORTON, R. L. *Teaching Arithmetic in the Intermediate Grades*, Chap. I. Silver, Burdett and Company. 1927.
8. OSBURN, W. J. *Corrective Arithmetic*, Chaps. I, II, and III. Houghton Mifflin Company. 1924.
9. REBARKER, HERBERT. "A Study of the Simple Integral Processes of Arithmetic," George Peabody College for Teachers, *Contributions to Education*, No. 26. 1926.
10. REED, H. B. "Distributed Practice in Addition," *Journal of Educational Psychology*, Vol. XV, pp. 248–249. 1924.
11. SMITH, NILA B. "An Investigation of the Uses of Arithmetic in the Out-of-School Life of First-Grade Children," *The Elementary School Journal*, Vol. XXIV, pp. 621–626. 1924.
12. THORNDIKE, E. L. *The Psychology of Arithmetic*, Chap. I. The Macmillan Company. 1922.
13. WILSON, G. M. "A Survey of the Social and Business Use of Arithmetic," Second Report of the Committee on Minimal Essentials in Elementary School Subjects, *The Sixteenth Yearbook of the National Society for the Study of Education*, Part I.

CHAPTER XX

THE PSYCHOLOGY OF ARITHMETIC *(Continued)*

Simplicity of explanations. It is a fundamental principle in learning that concepts are developed through experience. It is true also that the child learns new concepts in terms of those already established. Teachers must ever guard against assuming that the child has certain concepts and basing their teaching on this assumption. The acquisition of the concept of "one-third" is not a simple process, but, after the concept is acquired, it appears to be rather simple. In order to build such a concept, the teacher can make use of some simple illustrations, as dividing among three children an apple, or a stick, or any other material that lends itself to such treatment.

A fault most commonly found in textbooks on arithmetic is their brevity of explanation. This is not so true of recent texts. The new processes are frequently abbreviated in such a manner that only adults familiar with the arithmetical processes are able to understand these. Often they are not introduced in a language or manner that is in keeping with the mental and educational development of the child. Too frequently they are introduced as isolated foreign processes and are thus meaningless to the pupil. New processes should be introduced in simple language and with full explanations. They should not be carried beyond the experience and development of the child. Good teaching guides the acquisition of new processes and sets up an opportunity for the enrichment and the growth of concepts already established.

Understanding of principles versus memorizing. A point rather well established by the scientific investigations relating to learning and retention is that facts learned and unrelated to any known facts have little transfer value, and generally cannot be applied definitely in actual experiences. Rather than burden the pupil with the memorization of many rules placed before him in an abstract manner the teacher should strive to see that the principles are understood and mastered. A definition or rule usually involves one central thought centering around a few key words. Once the principle is understood the teacher can aid the pupil in arriving at a statement of the rule; but the student should himself state the rule. The teacher should not require the pupil to give the rule in the exact words of the text.

This general principle of understanding applies chiefly to problem work in arithmetic. There are other fundamental habits which are essential for progress in arithmetic and which can only be established by a process of active drill. Such are the habits involved in the acquisitions of the combinations in arithmetic, as $3 + 4$ or 5×2. Even here, however, some important principles can be used by the teacher. She should see that the principle of checking is carried out. This has many rather distinct values for the pupils which might be enumerated, as: (1) evaluation of their own work, (2) a fuller understanding of the reverse process, (3) a furtherance of the knowledge of the general relations involved between the different processes, and (4) the applications of the different processes in a more concrete manner which aids in developing a scientific attitude. The principle back of checking is the use of the reverse process. Nothing enables the student to understand better the significance of the different processes than this factor, and probably nothing will aid the student more in the development of a scientific outlook. In learning combinations a grave danger enters when tables are laid down and pupils directed to learn the combinations by rote from the beginning to the end of the table. Here the child is likely to form such habits that when the product of a combination is desired the student will begin at the first of the table and thus arrive at the answer. This is the case in many life activities where the habits are formed in a rote order.

Some difficulties encountered. The teacher should have a knowledge of the difficulties encountered by the elementary pupil and see that he does not fall into a difficulty and become lost in the subject. One of the earliest problems the teacher of the elementary grades meets is that of preventing the use of "crutches." Among examples of crutches used by the elementary student might be listed these: counting on the fingers, putting down numbers when "carrying" in addition, sole dependence on signs, simple tables, etc. Many habits are formed during the elementary stages of learning arithmetic that have to be broken later. Such is the case in examples which are written as follows:

$$\begin{array}{rrrrr} 42 & 80 & 70 & 60 & 65 \\ -33 & +7 & -24 & +31 & +33 \end{array}$$

In the above examples if the pupil in algebra is told to subtract the lower numbers from the upper ones the habits formed during his study of arithmetic will function in such a way that it becomes a problem for the teacher to break down the old habits. Such is the result of building up habits of dependence on signs. The pupil should get rather the meaning of subtraction, addition, and the other operations, and from this meaning apply the correct process in the solving of problems. Although the use of signs is frequently necessary in examples, the pupil must not learn to depend entirely on them.

Another difficulty often encountered by pupils at all stages in the acquirement of skill in arithmetic is that of understanding a new process. The trouble here lies chiefly in the textbook. In many cases the change from one process to another is abrupt and not a gradual, continuous one. The teacher should understand the principles of learning and apply these to the new elements in terms of processes already established. The elementary school child is not mentally mature enough to delve into abstract processes and, when a new element is introduced in a manner unrelated to elements already learned, the pupil is unable to comprehend the new situation. In order to enable the child better to understand abstractions, the new processes should be introduced with and compared to processes already familiar. That is, the similarities of the new process and some already established principle should be pointed out.

Another factor found among the difficulties encountered by the elementary pupil is that of making applications. This difficulty is due to a lack of correlation in the teaching of the process. The processes are taught as isolated unrelated elements, usually in a very abstract manner. Applications are often regarded as a second level of knowledge and they are not so easily measured by our ordinary standardized tests. Applications are important and the teacher should be sure that the principle is fully understood, not as an abstract process, but as a process that is concrete and one that can be used in meeting everyday problems, applied to games, etc.

Together with the lack of ability to apply the processes learned might well be mentioned one other difficulty that grows out of this and becomes one of the most serious handicaps to the child in the furtherance of his school work. This is general confusion. General confusion grows out of temporary confusion. Temporary confusion simply means inability to see through and understand the present process. If the pupil has met temporary difficulties a number of times and if these were not cleared up, general confusion will result when a new process is introduced depending upon other processes which the pupil has not mastered. What experienced teacher of elementary mathematics has not met this difficulty in the case of some pupil? The teacher finds a pupil who simply cannot get the principle of a new process. A closer analysis will probably reveal the fact that the pupil does not know the multiplication table except in a rote order, has never understood the relation between division and multiplication, or has similar difficulties. In the elementary skills, however, where the processes alone were being studied the pupil apparently seemed to get along very well.

Principles of economy in arithmetic study. Dewey[1] has emphasized the desirability of having pupils do their work as active, interested workers, conscious of problems whose solution satisfies some real need of their own natures. Other things being equal, it is not wise to lead pupils along blindly, not knowing where they are going nor why they are going. They ought rather to have some living purpose and be zealous in its attainment. However, it is often well to let the real importance of the attainment of certain aims unfold itself as the class proceeds. The importance of gaining information should be emphasized. Mere facts not gained by the child's own thinking are often of enormous value; they may stimulate to active thinking. Interest and ability are correlated in the sense that the pupil who has more interest in a subject than other pupils of his age is likely to have more ability in that subject than they. Interest and ability are correlated in the sense that the pupil who likes arithmetic better than geography or history tends to have more ability in arithmetic than in geography or history. Does the greater amount of interest result from the superior ability found? This question cannot be answered with certainty, but a pupil's interest in a subject can often be used as an index of that pupil's ability or progress in the subject.

---

[1] Dewey, John. *The Child and the Curriculum.* The University of Chicago Press. 1902.

The chapters on reading point out the fact that articulation in silent reading hinders both the rapidity and efficiency of thought getting. As in reading so it is in arithmetic; the direct linking of visual forms of digits and groups of digits, without the cumbersome and fatiguing auditory motor mechanism, leads to greater rapidity and accuracy in arithmetical calculation.

Conard and Arps[1] carried out an experiment in which the general problem of articulation in study was investigated. The two methods of work are referred to as the "traditional" and the "economical" methods.

The solution of the problem in the margin will serve as an illustration of the waste and fatigue in the prevailing method. When each digit and connecting terms are definitely expressed no less than seventy-one articulations are required. This number is increased by sixteen when the carrying process is formally expressed. Various abbreviations of this procedure are employed but it is exceptional to find a first-year high school student who, by

$$\begin{array}{r} 245\\ 987\\ 621\\ 876\\ 912\\ \underline{545}\\ 4186 \end{array}$$

---

[1] Conard, H. E., and Arps, G. F. "An Experimental Study of Economical Learning," *American Journal of Psychology*, Vol. 27, pp. 507–529. 1916.

naming the results, employs as few as seventeen in the solution.

The difference between 87 and 17 represents so much waste and fatigue. Special attention to the training of pupils in group addition would enable them to reduce this number to a minimum of ten words or less. In this study pupils were not trained in group additions for the reason that it would obscure the problem and for the additional reason that the manner of grouping would not be uniform for all pupils.

The Courtis Arithmetic Tests were given to a number of first-year high school pupils. From these 64 were selected and divided into two equal groups. Group T was drilled in the traditional method and group E was trained in the economical method. Both groups were given identical problems in each of the four fundamental operations. All objective conditions were equalized as completely as possible.

Each group was urged to solve the entire list of problems as rapidly and accurately as possible. The instructions given the pupils in group E differed from those given to the pupils in group T only in the additional direction that they think results only. It should be stated that this group was frequently reminded to think in terms of results only.

There were eight work periods for each group. To equalize the amount of practice for the two groups, and for all the individuals, the work-limit method was chosen in preference to the time-limit method. During work periods each pupil solved 7 problems in each of the four fundamental operations.

To provide a standard measurement, the Courtis Tests were given again after the last work period.

An examination of the relative efficiency of the two groups at the beginning of the experiment showed group T to be superior to group E. The average total time taken to complete the seven problems of each of the four fundamental processes showed that the time for group E was 5 seconds less than that for group T. In final tests group E showed superiority in the number of problems attempted, 11.2; in number correctly solved, 1; and 6.7 per cent less in variability. (Group T actually lost 2.5 per cent.) The economical method showed higher efficiency in reduction of the amount of time required.

Will learning a process transfer to the reverse process? It is usually assumed that skill acquired in a specific process in arithmetic will be transferred to the reverse of that process. For example, if a child learns 3 + 4, will this skill be transferred in equal degree to 4 + 3? This question is of vital importance to the teacher, because many of the combinations in arithmetic fall under the category of reverse processes. Experimentation shows that transfer from the practiced to the non-practiced function is never perfect, even though there are elements in common. ReBarker devised a formula to measure the dependence of a particular reverse combination on the combination. His experiments and data have already been referred to. He concludes from 720 coefficients of dependence, "The probable degree of dependence is found to be greatest in the reverse combinations of multiplication. It is found to be least in the reverse combinations of addition. . . . The lack of a marked probable degree of dependence beween the reverse combinations in each of the fundamentals justifies the conclusion that specific skills should be formed through practice in the total possible simple combinations of each of the fundamentals."[1] The results and conclusions from this study indicate that practice should be carried out in all the combinations.

If it were known which combinations are inherently more difficult, the teacher could so construct her drill exercise as to give more attention to these combinations. The difficulty ratings by Clapp and ReBarker are the result of two factors, namely, the inherent difficulty of the combinations and the effect that experience and unequal training have produced. How much of the difficulty is due to the one factor and how much to the other is unknown at the present time. These studies point out the fact that errors are found most frequently in certain combinations. Therefore, it is these combinations which are not receiving proper stress. The teacher may well profit from these results in arranging class drills.

Relationship between achievement in arithmetic and achievement in the other elementary school subjects. At the present time a great many educators are interested in the question of the relation of achievement in the different subjects. This naturally involves the much discussed question of transfer of training. The doctrine of general mental discipline receives little attention from those who are acquainted with the scientific studies of arithmetic. But the question of transfer is not one in which there is full agreement. A number of experiments have been made in regard to the relation between achievement in the different subjects. Hackler[1] correlated results from reading tests with results from arithmetic tests secured from high school pupils. His results show very low correlations between arithmetical ability and reading ability. Wren[2] made a study of the relation between achievement in arithmetic and achievement in the other school subjects from data taken from the Demonstration School of Peabody College. His study includes tests from 110 pupils who entered the fourth grade and continued through the fifth, sixth, seventh, and eighth grades. His study shows low correlation between achievement in arithmetic and achievement in the other school subjects. Table LXXVI gives the results of this study. The conclusions that one would draw from this study are that a teacher cannot safely predict a pupil's achievement in arithmetic from test results in either spelling, composition, reading rate, or in reading comprehension. Good achievement in arithmetic is not closely related to good achievement in any one of these four abilities.

---

[1] ReBarker, Herbert. *Op. cit.*, p. 70.

---

[1] Hackler, J. M. "The Relation between Successful Progress in Mathematics, and the Ability to Read and Understand, and the Factors that Contribute to Success or Failure in Mathematics," *Unpublished Master's Thesis*, Department of Education, University of Chicago. 1921.

[2] Wren, F. L. *Unpublished Master's Thesis*, Department of Educational Psychology, George Peabody College for Teachers. 1925.

TABLE LXXVI. CORRELATIONS FOUND BETWEEN ARITHMETIC AND OTHER SCHOOL SUBJECTS (N = 110)

SUBJECTS CORRELATED WITH ARITHMETIC	ARITHMETIC				
	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade
Spelling	.20	.25	.17	.24	.22
Composition	.11	.21	.20	.33	.26
Reading Rate	.23	.18	.28	.32	.33
Reading Comprehension	.26	.42	.29	.40	.38

Provisions for individual differences. The general facts concerning individual variation in abilities are well illustrated by arithmetical ability. The development of the testing movement stimulated further interest in the individual. The subject matter in any grade must be presented in a variety of different ways because of individual differences. It is unfair to the pupils for the teacher to expect the fastest pupil in a grade to accommodate his pace to the slowest one. Table LXXVII gives the distribution of scores made on the Woody-McCall Mixed Fundamentals by pupils in a fourth-, a fifth-, a sixth-, a seventh-, and an eighth-grade class. A close analysis of this table revealed not only a very wide distribution in each grade but also a great deal of overlapping between the different grades. For example, there are pupils in the fifth grade who made a higher score than some of the pupils in the eighth grade.

Differences in intelligence. Probably the factor that is in a large measure responsible for this wide varia-

Table LXXVII. Showing Distribution of Woody–McCall Mixed Fundamentals Test Scores by Grades for a Small School System

Score	Grade				
	4	5	6	7	8
34					1
33			1	1	2
32			1	4	1
31			1	4	4
30			2	6	6
29			5	3	3
28			10	5	5
27			1	3	2
26			1	1	3
25			1	2	3
24			4	2	1
23		1	2	1	
22		3	1	2	2
21		2	2	1	1
20		2	2	1	
19		2	2	1	
18	1	3	1	1	
17	5	5	1		
16	3	5	1		
15	5	3	1		
14	3	3			
13	1	2			
12	5	1			
11	3	1			
10	3	1			
9	2	1			
8	1				
7	1				
6	1				
5	1				
4	1				

tion in performance on the Woody-McCall Mixed Fundamentals is due to the differences that exist in mental ability. Merrill[1] studied 210 children taken from special classes of the Oakland, California, public schools. The children studied were found to be deficient in arithmetical ability, when their attainments were measured by the Woody-McCall and the Cleveland survey tests. Fairbanks[2] and Goddard[3] studied the ability of feeble-minded children in arithmetical operations. Both found the feeble-minded very deficient in arithmetical operations. Fairbanks found that they were sometimes able to carry on some fairly difficult operations mechanically but were almost wholly lacking in the ability to apply the facts learned to more remote situations. It appears that ability to perform arithmetical operations is closely related to mentality.

Differences due to habits of work. Although mental ability might be considered the most important factor making for individual differences, another important factor is found in poor habits of work which are probably responsible for many failures in arithmetic. Failure in arithmetic is very closely related to failure in other school work. Buswell[4] gives the following three factors that condition failures in arithmetic, "(1) The materials of arithmetic, consisting of textbooks, practice exercises, and special devices; (2) the teacher's methods of instruction and her manner of presenting arithmetic to the pupils; (3) the methods and mental processes of the pupils." The habits that the pupil forms are results of these factors. Diagnostic studies from Buswell's work indicate clearly that defective habits of work are often not detected by the school at all. Pupils are found who have no understanding of the methods of dealing with new processes. The pupil goes about each problem blindly in a hit-or-miss fashion. Habits of carelessness, habits of inaccuracy, habits of non-persistence, poor memory habits, habits of failure to see the problem with which he is confronted, and similar habits are prevalent among eighth-grade pupils all over the country.

---

[1] Merrill, M. A. "The Ability of the Special Class Children in the 'Three R's'," *Pedagogical Seminary*, Vol. 25, pp. 88–96. 1918.

[2] Fairbanks, G. M. "Teaching the Three R's to Our Children," *Training School Bulletin*, No. 15, pp. 42–44. 1918.

[3] Goddard, H. H. "A Side Light on the Development of the Number Concept," *Supplement to the Training School*, No. 1, pp. 20–25. 1907.

[4] Buswell, G. T. *Op. cit.*, p. 1.

Sex differences. Several investigations have been conducted to determine what, if any, sex differences exist. These studies attempted to answer certain contentions that boys surpass girls in arithmetic. Phillips[1] concluded from an investigation in class drill covering a period of eight weeks that girls were superior to the boys in the tests of the fundamentals but that boys did better than the girls in the test of reasoning ability. Thorndike[2] reports a study in which 60 per cent of the boys passed or reached the median achievement of the girls of the same school grade. Studies by Starch [1] show that boys are superior to the girls with respect to ability to solve arithmetical problems, but Starch points out other studies in which girls surpass boys in activities like reading comprehension, writing quality, and spelling ability. Such sex differences in arithmetic as have been found are usually due to the fact that the activities called for in the arithmetic texts are more closely related to the habits and everyday activities of the boys than of the girls. Drill exercises do not show the existence of pronounced sex differences.

---

[1] Phillips, F. M. "Value of Daily Drill in Arithmetic," *Journal of Educational Psychology*, No. 4, pp. 159–163. 1913.

[2] Thorndike, E. L. "Measurements of Ability to Solve Arithmetical Problems," *Pedagogical Seminary*, No. 21, pp. 495–503. 1914.

QUESTIONS AND EXERCISES

1. Visit a class in arithmetic in the grades and observe the work for several days. Notice whether the pupils are prepared for the work which they are assigned. Does the teacher appear to anticipate difficulties which the children encounter? What methods are used to relate the day's work to previous work?

2. Is there a teacher in the school who seems to be especially interested in arithmetic? How do her pupils compare with the pupils of another teacher who is not so definitely interested in this subject?

3. In your observation, do you find pupils who articulate as they work examples? If so, inquire as to their achievement both with respect to speed and accuracy. Do you find any efforts being made to overcome this habit?

---

[1] Starch, Daniel. "The Measurement of Ability in Arithmetic," *Journal of Educational Psychology*. April, 1916.

4. What is meant by a "reverse process"? State ReBarker's conclusion with regard to whether learning a process transfers to a reverse process. How should his findings affect school practice in drill on the fundamental processes?

5. From the discussion in the text do you conclude that pupils who are best in arithmetic are generally best in the other subjects also?

SELECTED REFERENCES

1. Brown, J. C., and Coffman, L. D. *How to Teach Arithmetic.* Row, Peterson and Company. 1924.
2. Buswell, Guy Thomas, and Judd, Charles Hubbard. *Summary of Educational Investigations Relating to Arithmetic.* University of Chicago Press. 1922.
3. Hahn, H. H., and Thorndike, E. L. "Some Results of Practice in Addition under School Conditions," *Journal of Educational Psychology*, Vol. V, pp. 65–84. 1914.
4. Jessup, W. A. "Current Practice and Standards in Arithmetic," *The Fourteenth Yearbook of the National Society for the Study of Education*, Part I, pp. 116–130. 1922.
5. Kelly, F. J. "The Results of Three Types of Drill on the Fundamentals of Arithmetic," *Journal of Educational Research*, Vol. II. 1920.
6. Kirby, T. J. "The Results of Practice under School Conditions," Teachers College, Columbia University, *Contributions to Education*, No. 58. 1913.
7. Klapper, Paul. *The Teaching of Arithmetic.* D. Appleton and Company. 1916.

8. Lennes, N. J. *The Teaching of Arithmetic.* The Macmillan Company. 1923.
9. Morton, R. L. "An Analysis of Pupils' Errors in Fractions," *Journal of Educational Research*, Vol. IX, pp. 117–125. 1924.
10. Newcomb, R. S. *Modern Methods of Teaching Arithmetic.* Houghton Mifflin Company. 1926.
11. Osburn, W. J. *Corrective Arithmetic.* Houghton Mifflin Company. 1924.
12. Phillips, F. M. "Comparison of Work Done in the Successive Minutes of a Ten-Minute Practice Period in the Fundamentals of Arithmetic," *Journal of Educational Psychology*, Vol. VII, pp. 271–277. 1916.
13. Reed, H. B. *Psychology of Elementary School Subjects*, Chaps. IX, X, and XI. Ginn and Company. 1924.
14. Stevenson, P. R. "Increasing the Ability of Pupils to Solve Arithmetic Problems," *Educational Research Bulletin*, Vol. III, pp. 267–270. 1924.
15. Stone, J. C. *The Teaching of Arithmetic.* Benj. H. Sanborn & Co. 1918.
16. Thorndike, Edward L. *The Psychology of Arithmetic.* The Macmillan Company. 1922.

CHAPTER XXI

MEASURING THE RESULTS OF INSTRUCTION IN ARITHMETIC

Measurements. The primary purpose of standardized tests in arithmetic is to measure the results of teaching. By the use of the standardized test the teacher is able to compare the achievement of her pupils with the average achievement made by that particular grade as found when the tests are given to a large number of pupils selected at random. The statement of the aims of education includes many objectives, but "the abilities to perform the operations of addition, subtraction, multiplication, division, and fractions, both common and decimal," are generally considered among the desired outcomes. The purpose of measurement is to determine how well the aims of education are being met.

What are the elements to be measured? In performing the fundamental operations in arithmetic there are two objectives found: "skill" and "power." Skill refers to the rate and accuracy of performing the operation. In a test that involves skill the factors of time and number of operations that are correctly done are most important. On the other hand, if we wish to secure a measure of how difficult a problem a pupil can do, a power test is used. In the power tests the different operations increase rather uniformly in difficulty, whereas in the

COURTIS STANDARD RESEARCH TESTS

Arithmetic. Test No. 1. Addition

Series B Form 3

SCORE
No. Attempted . .
No. Right . . . . . .

You will be given eight minutes to find the answers to as many of these addition examples as possible. Write the answers on this paper directly underneath the examples. You are not expected to be able to do them all. You will be marked for both speed and accuracy, but it is more important to have your answers right than to try a great many examples.

339	799	952	937	489	789	872	309
276	584	397	274	877	555	657	964
977	135	535	468	482	342	329	673
861	647	669	836	645	908	794	437
757	624	386	323	761	471	563	338
698	512	974	485	598	896	128	591
269	146	458	357	352	123	856	636
136	699	702	925	431	637	962	704
322	109	397	819	367	254	287	119

125	473	782	485	781	602	761	656
767	318	403	539	945	770	978	282
632	272	555	285	574	358	820	878
306	857	688	147	497	625	747	390
290	425	349	875	926	348	504	614
949	693	814	387	832	585	939	563
883	469	397	126	668	992	485	207
418	954	966	604	303	645	268	791
574	346	329	418	729	377	356	138

595	399	907	735	246	356	250	845
303	275	293	354	357	409	707	372
587	583	468	512	400	970	442	689
281	777	272	695	579	648	991	835
776	841	753	849	782	593	697	426
642	656	836	402	691	861	754	745
624	924	969	987	968	938	836	813
958	365	637	298	834	223	788	197
139	463	293	128	125	555	177	686

Name . . . . , ... , Age last birthday . . . .
Boy or Girl
School . . . . Grade . . . . Room . . . .
City . . . . State . . . . Date . . . .

THE WOODY ARITHMETIC SCALES

PUBLISHED BY
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

ADDITION SCALE A

City.............County.............School.............Date..........
Name.........................When is your next birthday?...............
How old will you be?............Are you a boy or a girl?..................
In what grade are you?..........Teacher's name.........................

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2 3	2 4 3	17 2	53 45	72 26	60 37	3 + 1 =	2 + 5 + 1 =	20 10 2 30 25

(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
21 33 35	32 59 17	43 1 2 13	23 25 16	25 + 42 =	100 33 45 201 46	9 24 12 15 19	199 194 295 156	2563 1387 4954 2065

(19)	(20)	(21)	(22)	(23)	(24)	(25)
$ .75 1.25 .49	$12.50 16.75 15.75	$8.00 5.75 2.33 4.16 .94 6.32	547 197 685 678 456 393 525 240 152	$\frac{1}{3} + \frac{1}{3} =$	4.0125 1.5907 4.10 8.673	$\frac{3}{8} + \frac{5}{8} + \frac{7}{8} + \frac{1}{8} =$

(26)	(27)	(28)	(29)	(30)	(31)	(32)
$12\frac{1}{2}$ $62\frac{1}{2}$ $12\frac{1}{2}$ $37\frac{1}{2}$	$\frac{1}{8} + \frac{1}{4} + \frac{1}{2} =$	$\frac{3}{4} + \frac{1}{4} =$	$4\frac{3}{4}$ $2\frac{1}{4}$ $5\frac{1}{4}$	$2\frac{1}{2}$ $6\frac{3}{8}$ $3\frac{3}{4}$	113.46 49.6097 19.9 9.87 .0086 18.253 6.04	$\frac{3}{4} + \frac{1}{2} + \frac{1}{4} =$

(33)	(34)	(35)	(36)	(37)
.49 .28 .63 .95 1.69 .22 .33 .36 1.01 .56 .88 .75 .56 1.10 .18 .56	$\frac{1}{8} + \frac{3}{8} =$	2 ft. 6 in. 3 ft. 5 in. 4 ft. 9 in.	2 yr. 5 mo. 3 yr. 6 mo. 4 yr. 9 mo. 5 yr. 2 mo. 6 yr. 7 mo.	$16\frac{1}{3}$ $12\frac{1}{8}$ $21\frac{1}{2}$ $32\frac{3}{4}$

(38)
25.091 + 100.4 + 25 + 98.28 + 19.3614 =

skill tests the operations involve practically the same difficulty all the way through. The Courtis Test, page 480, is a good illustration of a skill test. In this test the different examples are not arranged in order of difficulty but rather the assumption is made that they are of approximately equal difficulty. The Woody Scale, on the other hand, is composed of examples which increase in difficulty at a rather uniform rate.

In addition to the two objectives of measurement that are set forth above, other tests of the ability to solve problems are found, as tests of reasoning in arithmetic. Tests of this nature are based on the ability of the pupil to formulate a correct plan for the solution of a problem. In tests of this kind the accuracy of the plan formulated is of more importance than the rate of formulating the plan. However, there is usually found a close relationship existing between the two. In selecting a test for use in measuring achievement in arithmetic, it is necessary to have definitely in mind what the purpose of administering the test is. If the teacher merely wishes to measure achievement, a general test in the fundamentals will be sufficient. But if she is concerned with the details of the instruction and the further needs of her pupils, there must be detailed information concerning the types of examples the pupils can do with a satisfactory degree of ease and the types they cannot do. In this case a more elaborate test is needed, in order to find the place and nature of the pupils' weaknesses so that instruction may be adjusted in accordance with these. It is here that diagnostic tests are of great value.

General survey tests in arithmetic. Courtis constructed the Courtis Standard Research Tests, Series B, during the year 1913–1914. These tests consist of a series of four tests, comprising the fundamentals of arithmetic. Because of the fact that separate measures for each of the operations with integers is found, the tests might be thought of as diagnostic, but those within each field of operation are general. The Courtis Arithmetic Test is a test of skill rather than power. This test has been used widely for measuring arithmetical abilities, and norms were established from a large number of scores.

The Woody-McCall Mixed Fundamentals Tests consist of a single scale constructed from the Woody Arithmetic Scales, Series B. The different operations do not appear in any regular order but in an order gradually increasing in difficulty. This test is printed in four different forms, and norms have been established for all forms. The chief value of this scale is mainly for supervisory and survey purposes. It measures general arithmetic ability in the four fundamentals. This test is a power test; the problems seem to have been selected mainly on the basis of their increasing difficulty.

The Cleveland-Survey Arithmetic Tests are designed for use in Grades IIIB to VIII. The examples in the different tests are approximately equal in difficulty. The purpose of this test is primarily diagnostic. Although it has certain weaknesses as a diagnostic test, it has been used very widely for this purpose. In the Cleveland-Survey Tests time is allowed for each subtest and the pupil is graded according to the number of examples solved correctly. All the examples in any of the sets from A to O inclusive are of approximately equal difficulty. The median scores for these tests were found from the results secured by giving the test in some large school system.[1]

The Monroe Diagnostic Tests in Arithmetic consist of a series of twenty-one tests. These tests are printed on four-page folders and are divided into four parts. Each test is timed separately and in most cases the time allowances are rather short. These tests are a measure of skill rather than power. It is possible to use the tests as a general survey scale by combining the results from all the tests into one score, but the purpose of the test is diagnostic and a combination of the results from the test items is not recommended. Norms for this test, as in other diagnostic tests, are probably not so reliable; neither are they so necessary as are norms for general tests.

Tests for ability to formulate the correct solution of problems. In the processes involved in the solution of problems it is found that every problem includes at least three quantities. There are two given quantities that are related in some way to each other and a third which is found from the two related. In the solution of problems any or all of the fundamental processes may be used. The words in which the problem is stated tell what relations exist, and it is through the understanding of these relations and of the proper arithmetical operations that the problem is solved. The following steps are necessary for the solution of verbal problems: (1) ability to attend to the problem; (2) mental set; (3) interpretation of the problem; (4) planning a solution, using the data of (1) and (2) above; (5) ability to carry out the plan; (6) checking results and verification. Most reasoning tests are essentially general.

---

[1] Monroe, DeVoss, and Kelly. *Educational Tests and Measurements*, pp. 39–40. Houghton Mifflin Company. 1924.

Monroe's Standardized Reasoning Tests in Arithmetic[1] are designed for Grades IV to VIII. Each problem of the tests has two values, "correct principle value," and "correct answer value." Norms have been established by Monroe for the correct principle value, rate, and correct answer value.

Qualities of a good examination in arithmetic. Years ago the reliability and validity of the results of the old-type examinations were questioned by no one. Everyone accepted them as final and the pupil was passed or failed accordingly. In studies of these types of examinations it has been shown that teachers disagree enormously in their attempt to grade the same paper. Furthermore, it has been found that the same teacher will give the same paper very different marks at different intervals of time. Thus the mark a pupil got on his paper depended partly upon

[1] Monroe, W. S. "Report of Division of Educational Tests for 1919–20," *Bureau of Educational Research*, Bulletin 5, University of Illinois Bulletin, Vol. XVIII, No. 21, pp. 36–47.

what was placed on the paper, partly upon the teacher grading, and partly upon the attitude of the teacher at the time of grading the paper. One cannot question the value of examinations, but in any examination two sources of errors are always likely to enter.

The first source of error is that of *sampling*. Examinations are really samplings of the materials learned and the responses made to these samplings give the teacher an index to the knowledge that the pupil has of the subject. The old-type examination took a few samplings and if the pupils responded the way the teacher wanted them to, their grades were good; otherwise they were bad. Often also in the old-type examination the reviews were largely a matter of "spotting" the teacher, *i.e.*, guessing what the teacher was going to ask on the examination. Reviews were not systematic, for the old-type examination and questions were of a general type. The sampling in this case did not cover a wide enough range of topics and very likely gave too much emphasis to those points in which the teacher was especially interested.

Another source of error that entered into the old type of examination was the lack of objectivity in giving and scoring. In the first source of error, validity might well be thought of as the problem involved. In the second source of error, the reliability of the examination is questioned. Non-objective examinations encourage bluffing on the part of verbose individuals who are deficient in knowledge of the subject. For a test to be objective the methods of giving and scoring should be uniform. If this is the case the results should be approximately the same when different individuals give and score the test.

One of the most common forms of objective tests is that of the alternate-response. The most generally used alternate-response test is the "true-false" type. According to this method, a series of statements is given the pupils. These statements are usually in mimeographed form, unless they are standardized tests bought from the publishers, and the pupils are instructed to respond to the questions by some notation as to whether the questions are true or false. Each item may have the word "true" or "false" after it, or "yes" or "no." The pupils are instructed to underline "true" if the statement is correct and "false" if the statement is incorrect. The type of test is illustrated in practically all books on tests, and in many of the educational texts may be found tests of this type.

A modification of the "true-false," and slightly superior to it, is the multiple-response test. The following examples illustrate the multiple-response type of exercises:

1. $6 + 5 - 2$ equals 8 9 10 11
2. One half is less than . . . . one fourth, one third, three fifths, four tenths
3. A boy had 8 pencils and gave his sister 3. Afterwards he bought 2 more pencils, he then had . . . . 6 pencils, 5 pencils, 8 pencils, 7 pencils

In the above exercises the pupils are asked to underline the correct answer. This type of exercise is best adapted to subject matter involving thought processes rather than the elementary skills.

The matching test in arithmetic can be illustrated by the following exercise:

First List	Answers	Second List
1. A mile	______	One gallon
2. Four quarts	______	One bushel
3. Four pecks	______	31 days
4. One-half yard	______	$16\frac{1}{2}$ feet
5. One rod	______	18 inches
6. One year	______	1760 yards
7. January	______	365 days

Matching tests are very good for certain types of activities in arithmetic but their greatest value is limited to specific phases of arithmetic. They are best used in connection with such factors as: (*a*) areas and measures; (*b*) definitions and their illustrations; (*c*) common fractions and their decimal equivalents; and (*d*) per cents and their common fractional equivalents.

One other type of test which can be used successfully in work with the fundamentals and which is found in many textbook exercises is as follows:

$7 \div 3$ ______.
$8 \div 2$ ______.
8×2 ______.
$4 + 3$ ______.
4×2 ______.
$4 - 1$ ______.

Completion exercises may be used as tests and are valuable for some types of material as, "There are ——— days in the month of January and ——— days in the month of June." Scores on completion test exercises correlate highly with intelligence test scores. Some writers have questioned their validity largely on that basis, claiming that completion exercises are probably better measures of intelligence than of a knowledge of the subject in connection with which they are used. This sometimes is quite true, but where the exercises are of such nature that the pupil can clearly see what is desired, and when the responses depend upon whether or not he has the necessary knowledge to meet the requirements, the completion exercise is a valid measure of the pupil's knowledge of the subject. The usual trouble with the completion exercise is that it is difficult and expressed in such language that the entire exercise is wholly unrelated to the child's experience. If the completion exercise is chosen, it must be used rather cautiously by the teacher.

Only a few of the most commonly used objective types of tests have been discussed here. For a fuller understanding of the different types the reader should become familiar with some of the most commonly used standardized tests.

QUESTIONS AND EXERCISES

1. List purposes for which teachers may use standardized arithmetic tests. Which are the most important?
2. How may the results of tests be used for supervisory

purposes? For purposes of locating pupils who need individual attention? For purposes of motivation?

3. Construct an informal arithmetic test designed to measure the results of instruction in some topic in arithmetic which you have observed being taught.

4. Secure samples of arithmetic tests. List the abilities which each measures.

5. What are the elements to be measured in arithmetic? Name several tests which will measure these elements.

6. Give a standardized test to a class and score the papers. Arrange the papers from best to poorest and then construct a graph which shows the result for the grade and for each pupil. (See Figure 7, page 177.)

SELECTED REFERENCES

1. ANDERSON, C. J. "Use of the Woody Scale for Diagnostic Purposes," *The Elementary School Journal*, Vol. XVIII, pp. 770–781. June, 1918.
2. BROOKS, S. S. *Improving Schools by Standardized Tests*. Houghton Mifflin Company. 1922.
3. GILLILAND, A. R., and JORDAN, R. H. *Educational Measurements and the Classroom Teacher*, Chap. IX. The Century Co. 1924.
4. HINES, H. C. *A Guide to Educational Measurements*, Chap. XVII. Houghton Mifflin Company. 1923.
5. MORTON, R. L. "Pupils' Errors in Solving Arithmetic Problems," *Educational Research Bulletin*, Vol. XIV, No. 8, p. 155, Ohio State University. April 15, 1925.
6. SMITH, H. L., and WRIGHT, W. W. *Tests and Measurements*, Chap. V. Silver, Burdett and Company. 1928.
7. TRABUE, M. R. *Measuring Results in Education*, Chaps. XII and XIII. American Book Company. 1924.

CHAPTER XXII

THE PSYCHOLOGY OF DRAWING

What is meant by drawing? Manuel, who made a careful quantitative study of talent in drawing, says, "The term, 'drawing' designates a process of causing, by means of pencil, pen, brush, or other instrument certain lines or areas, or both, to appear on a given surface." As pointed out by Manuel,[1] the drawing may be a picture or representation of some object; it may be of a symbolic nature just as are most words; or it may be some form of design which does not represent or symbolize any particular thing but which gives a feeling of harmonious combinations of colors or lines.

Drawings may be classified in many other ways according to the purpose of the writer or the method of work employed and the meanings conveyed. Hollingworth[2] makes the following classification: "(1) copying, (2) representative drawing, (3) analytical or diagrammatic drawing, (4) impressionistic drawing, (5) symbolic drawing, and (6) caricature." Every drawing has to a greater or lesser degree an ideational and aesthetic content. These characteristics are found in various proportions in different drawings. They range from drawings in which the purposes? For purposes of locating pupils who need individual attention? For purposes of motivation?

---

[1] Manuel, H. T. *Talent in Drawing,* p. 110. The Public School Publishing Company. 1919.

[2] Hollingworth, Leta S. *Special Talents and Defects,* p. 141. 1923. By permission of The Macmillan Company, publishers.

3. Construct an informal arithmetic test designed to measure the results of instruction in some topic in arithmetic which you have observed being taught.

4. Secure samples of arithmetic tests. List the abilities which each measures.

5. What are the elements to be measured in arithmetic? Name several tests which will measure these elements.

6. Give a standardized test to a class and score the papers. Arrange the papers from best to poorest and then construct a graph which shows the result for the grade and for each pupil. (See Figure 7, page 177.)

SELECTED REFERENCES

1. ANDERSON, C. J. "Use of the Woody Scale for Diagnostic Purposes," *The Elementary School Journal*, Vol. XVIII, pp. 770–781. June, 1918.
2. BROOKS, S. S. *Improving Schools by Standardized Tests*. Houghton Mifflin Company. 1922.
3. GILLILAND, A. R., and JORDAN, R. H. *Educational Measurements and the Classroom Teacher*, Chap. IX. The Century Co. 1924.
4. HINES, H. C. *A Guide to Educational Measurements*, Chap. XVII. Houghton Mifflin Company. 1923.
5. MORTON, R. L. "Pupils' Errors in Solving Arithmetic Problems," *Educational Research Bulletin*, Vol. XIV, No. 8, p. 155, Ohio State University. April 15, 1925.
6. SMITH, H. L., and WRIGHT, W. W. *Tests and Measurements*, Chap. V. Silver, Burdett and Company. 1928.
7. TRABUE, M. R. *Measuring Results in Education*, Chaps. XII and XIII. American Book Company. 1924.

CHAPTER XXII

THE PSYCHOLOGY OF DRAWING

What is meant by drawing? Manuel, who made a careful quantitative study of talent in drawing, says, "The term, 'drawing' designates a process of causing, by means of pencil, pen, brush, or other instrument certain lines or areas, or both, to appear on a given surface." As pointed out by Manuel,[1] the drawing may be a picture or representation of some object; it may be of a symbolic nature just as are most words; or it may be some form of design which does not represent or symbolize any particular thing but which gives a feeling of harmonious combinations of colors or lines.

Drawings may be classified in many other ways according to the purpose of the writer or the method of work employed and the meanings conveyed. Hollingworth[2] makes the following classification: "(1) copying, (2) representative drawing, (3) analytical or diagrammatic drawing, (4) impressionistic drawing, (5) symbolic drawing, and (6) caricature." Every drawing has to a greater or lesser degree an ideational and aesthetic content. These characteristics are found in various proportions in different drawings. They range from drawings in which the

---

[1] Manuel, H. T. *Talent in Drawing*, p. 110. The Public School Publishing Company. 1919.

[2] Hollingworth, Leta S. *Special Talents and Defects*, p. 141. 1923. By permission of The Macmillan Company, publishers.

He reaches the conclusion that the process of graphical expression is subject to the influence of three interrelated factors: "(1) a preconceived purpose, (2) ability to see, and (3) ability to represent." The preconceived purpose varies with the interests of the individual and the purpose to be served. Ayer notes the following: (*a*) for a purpose of learning, (*b*) to list items of information, (*c*) for representation, (*d*) for interpretation, (*e*) for illustration. He thinks that the ability to make analytical observations is largely innate and is peculiar to the various types of drawing. Manuel[1] studied a number of gifted children by means of the test method. In summarizing his findings with regard to the psychological factors involved in drawing he gives this analysis:

> The following characteristics, each an independent or partially independent variable, seem closely related to ability in drawing:
>
> 1. The ability mentally to note a visual form, and, by certain lines and areas, to reproduce it or significant features of it.
> 2. Ability to observe.
> 3. Ability to select from a complex visual situation the most representative and the most beautiful aspects.
> 4. Memory of visual forms.
> 5. Ability mentally to manipulate visual forms.
> 6. Ability to control hand movements in accordance with visual percept or image.

---

[1] Manuel, H. T. *Op. cit.*, p. 133.

7. Ability to invent, to bring together into new artistic combinations the elements of different visual experiences.
8. Ability to judge the beautiful in line, form, color, and composition.
9. Ability to discriminate differences in color.
10. Ability to discriminate differences in visual magnitude.
11. Acuity of vision.
12. Interest in the act and products of drawing.
13. General intelligence.

The problem was approached in a different manner by Meumann who analyzed the causes of inefficiency in drawing. He studied both the talented and the deficient in drawing ability. His traits of talent have been conversely stated by Meier [1] in the following manner:

> (1) The will to analyze and notice forms and colors, (2) memory of spatial relations and what is to be represented, (3) ability to hold image during the drawing, (4) coördination of perceptual image with drawing movements, (5) use of a schemata on which to found the drawing, (6) comprehension of methods for projecting space in three dimensions on a plane, (7) manual skill, and (8) artistic sense.

Meumann thinks that the first four characteristics listed are largely innate.

All the writers quoted agree that it is not necessary for any person to possess all the psychological traits to a high degree in order to be successful in drawing. The traits may be combined in a person in various ways. Great individual differences with respect to a trait may appear among those who are talented to a high degree. The traits listed, however, may be regarded as significant for talent in drawing. All persons possess each of them to a certain degree. If a child happens to possess each of them to a great degree or if he possesses a fortunate combination of them, he has the ability to become exceptional in the subject.

---

[1] Meier, N. C. "Aesthetic Judgment as a Measure of Art Talent," *University of Iowa Studies*, Vol. I, No. 19, pp. 15–16.

Talent in drawing may be regarded as a complex function which is composed of a number of more elementary and largely specific functions. These elementary functions are to a large extent innate. Their integration into the larger function generally spoken of as talent in drawing is a result of training.

What are the aims of art education in the grades? The aims of any study are to be stated in terms of what the subject does for the child by furnishing him with a means for reacting with insight to the things about him. A second way of stating the aims of a subject is in terms of the social needs supplied. Broadly speaking, any school subject may be considered from the following points of view: How does it affect the feelings and attitudes of the individual? Does it affect the intellectual life of the individual by providing for greater insight and accuracy in observation? Does it provide training which makes for more accurate expression? The writers do not intend to imply that training in any field will provide growth in one direction without influencing the growth of the individual as a whole. The aims of drawing in the grades may be stated in terms of (1) expression, (2) observation, and (3) appreciation. These terms are not mutually exclusive but they do furnish us with a notion of the function of drawing in the child's training.

Factors affecting the acquisition of skill in drawing. In addition to the factors found in a psychological analysis of ability in drawing, there are others which affect the acquisition of skill in drawing. These may be considered apart from the innate ability of the pupil as environmental influences. These factors may be listed as follows:

a. Interests and ability of the teacher
b. Good methods of teaching and learning
c. Home influences
d. Other environmental influences, as playmates, Sunday school teacher, etc.

The teacher is undoubtedly one of the most powerful motivating influences in the development of skill in any school subject. If she has skill in drawing and is interested in the subject, she will use this skill in illustrating the work of the school. Children early acquire the habit of copying their elders. The teacher who uses her skill in drawing may be sure that with a little encouragement her pupils will be motivated to use drawing as one means of expression. Good methods of teaching and learning are closely related to the interests and the ability of the teacher.

In drawing, as elsewhere in school, economical learning depends upon several factors. It is a first principle in learning that the experiences to be received should be based on previous ones. Then, too, the work should be so arranged as to grow out of previously developed interests. Drawing functions in the acquisition of practically all the school subjects and the development of ability in drawing may be facilitated through proper correlation with geography, literature, and the other subjects.

Agencies outside the school frequently furnish incentives for drawing. A home in which some members of the family make use of this ability in expression creates a favorable environment for the young child. In leading the child to express himself by means of drawings it is worth the teacher's effort to find what the child's interests are apart from school and to tie up the work of the school with these.

Children's interests in drawing. A number of studies have been made concerning children's interests in drawing. These studies all show that younger children, when allowed to draw as they please, are more interested in drawing the human form or some part of the body than they are in drawing any other object. The drawings of children up to ten years of age remain substantially the same, as far as the subject is concerned, as those of younger children. However, there is a steady decline in the per cent of children who reproduce the human form, while things which might be classified as nature forms (animals, plants, etc.) rise steadily. There are great individual differences as shown in children's interests. Many of these are the results of immediate environmental influences and are not of permanent value. The choices of children who were allowed to select their own subjects for drawing are shown in Chart III. McCarty [1] made a study of 31,239 drawings and the figure is based on her findings. As she points out, certain tendencies are manifested in the change of subjects with age. An examination of the figure reveals that the number of reproductions of the human form decrease steadily from the fourth to the eighth year. The nature subjects tend to increase while certain of the other subjects are irregular.

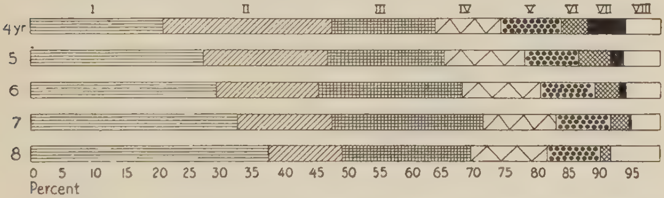


Chart III. Comparison of Ages for Classes of Subjects Drawn

I. Nature
II. Human beings
III. Buildings
IV. Furniture and domestic
V. Tools and vehicles
VI. Toys
VII. Scribble
VIII. All other classes

Drawing and intelligence. A number of investigations have been made concerning the relation between intelligence as measured by various group and individual intelligence tests, and drawing ability as measured by various scales and tests. The results of such studies are not in agreement, indicating that the relation is not the same between the various kinds of drawing and intelligence. In discussing the relation between drawing and general intelligence it is therefore necessary to specify the type of drawing under consideration.

---

[1] McCarty, Stella Agnes. *Children's Drawings: A Study of Interests and Abilities*, Chap. I, p. 25. Williams and Wilkins Company, Baltimore, Md. 1924.

One of the most interesting and important recent studies was made by Miss Goodenough.[1] She had a large number of children in the primary grades draw under the following instructions:

> On these papers I want you to make a picture of a man. Make the very best picture that you can. Take your time and work carefully. I want to see whether the boys and girls in —— school can do as well as those in other schools. Try very hard and see what good pictures you can make.

After the drawing specimens were secured, Miss Goodenough had them scored according to a set of rules which she had developed. Table LXXVIII[2] summarizes her findings when Goodenough drawing mental ages were correlated with Stanford-Binet mental ages. It will be noticed that a high degree of correlation was found between mental age as measured by the drawing test and mental age as measured by the intelligence test. This seems to indicate that the ability to draw the human form is composed of a number of factors which are closely related to those measured by the Binet-Simon Scale.

---

[1] Goodenough, Florence L. *Measurement of Intelligence by Drawings.* Copyright 1926 by World Book Company, Publishers, Yonkers-on-Hudson, New York.

[2] *Ibid.*, p. 50.

TABLE LXXVIII. CORRELATION BETWEEN STANFORD-BINET MENTAL AGE AND DRAWING MENTAL AGE *

AGE	NUMBER OF CASES	r	P.E.
4	25	.863	.034
5	94	.699	.035
6	65	.832	.025
7	63	.716	.042
8	27	.557	.092
9	37	.728	.053
10	23	.849	.041

* Modified after Goodenough.

In connection with the close relationship found between the ability to draw the human form and intelligence, it is interesting to note the growth of children from age to age in their ability to notice the different parts of the body and represent them in their drawings. Table LXXIX shows data collected by Partridge[1] and Goodenough[2] and arranged by the latter. An examination of the table shows that the children of the two groups noted in the same order the four items listed: trunk, arms, neck, hair. The growth appears to be rather regular from age to age also.

---

[1] Partridge, Lena. "Children's Drawings of Men and Women," *Studies in Education*, by Barnes, Vol. II, pp. 163–179. 1902.

[2] Goodenough, Florence L. *Op. cit.*, p. 35. Copyright 1926 by World Book Company, Publishers, Yonkers-on-Hudson, New York.

TABLE LXXIX. PER CENT OF CHILDREN DRAWING DIFFERENT PARTS OF THE BODY AT SUCCESSIVE AGE LEVELS

AGE	4	5	6	7	8	9	10
Hair:							
Partridge	6	26	27	32	38	58	70
Goodenough normal group	16	13	16	22	45	45	58
Neck:							
Partridge	8	22	20	37	51	63	79
Goodenough normal group	5	14	26	44	66	74	83
Arms:							
Partridge	45	67	71	80	76	85	93
Goodenough normal group	55	64	83	88	91	92	98
Trunk:							
Partridge	50	82	92	93	98	99	98
Goodenough normal group	59	74	87	99	99	100	100

Individual differences in ability to draw. Individual differences in drawing ability may be considered from two viewpoints. Individuals who are talented in drawing differ very widely in the various abilities which are associated with talent. Manuel,[1] who made a special study of the psychological characteristics of the talented, found the outstanding characteristic of such persons to be the variability among them in physical and mental traits. Normal individuals are those who possess less than average ability when these traits are considered as a whole or who have such poor ability in one or two traits as to make it impossible for the individual to do better than the average in drawing. A superior individual with regard to the subject would be one who possessed a favorable degree of ability in the traits.

---

[1] Manuel, H. T. *Op. cit.*, p. 114.

The way individuals differ in drawing ability when the ability is considered as a whole may be studied. McCarty,[1] who studied the range of ability through the application of scales which she developed, says:

> In the range of distribution there is enormous overlapping from year to year. The most gifted four year old children reach or exceed the median score for eight year old children, and, vice versa, the least gifted of the eight year group only approximate the median for the youngest kindergarten children; but in every case, either the lower end of the curve for any younger group is below the lower end of the curve for the next older group or the frequency for the lowest scores is greater for the younger children. Also the upper end of the curve for the older group is nearly always above the upper end of the curve for the next lower group. No eight year child draws as poorly as the poorest four year old, and no four year child draws as well as the best eight year old.

It is important that teachers recognize the wide range of ability found in the typical grade and attempt to make provision accordingly in the work of the grade. In this subject as well as in music there is a strong tendency for the teacher to neglect the pupil with poor ability by assigning any task which relates to the work of the grade as a whole to the child with superior ability and by leaving the pupil with poor ability with no assignment. The child with unusual ability should not be neglected. Indeed, it is highly desirable that society conserve all the art talent it has, but the pupil with poor ability is capable of some development and therefore should be assigned tasks within the limits of his ability. Since instruction in drawing consists largely of individual projects, it is easier to make provision for individual differences here than in most subjects. Thorndike[1] in 1913 published the first drawing scale. Kline and Carey,[2] McCarty,[3] Meier,[4] and others have published scales in more recent years. Kline and Carey constructed four scales for representation, one for measuring a drawing of each of the following: a house or other building, a rabbit or squirrel, a tree, a boy running. In using the scales, the pupils are told to draw from memory a sample of each of the four subjects treated in the scales. The samples are scored by comparing each to the drawings on the appropriate scale. After the pupils' drawings have all been scored, an average is found for each pupil.

---

[1] McCarty, Stella Agnes. *Op. cit.*, p. 71.

The chief value of the drawing scales constructed up to the present time lies in their use as instruments for purposes of motivation. By making scales available for pupil use, the teacher can set objective goals before the class. Pupils are able to see and measure their improvement from time to time.

---

[1] Thorndike, E. L. "Measurement of Achievement in Drawing," *Teachers College Record*, pp. 345–382. November, 1913.

[2] Kline, L. W., and Carey, Gertrude L. "A Measuring Scale for Freehand Drawing," The Johns Hopkins Press. 1922.

[3] McCarty, Stella A. *Children's Drawings.* Williams & Wilkins Co. 1924.

[4] Meier, N. C. "Aesthetic Judgment as a Measure of Art Talent," *University of Iowa Studies*, Vol. I, No. 19.

Regarding measurement of drawing Kline and Carey[1] state:

> It is doubtless true that we have acquiesced all too long in the notion that the products of drawing were due to more or less mysterious gifts independent of methodical instruction and painstaking effort. When it is once realized that talent, so-called, shares in equality of distribution with the gifts involved in the mastery of the other common branches, and that higher products of art are made possible by the mastery of its fundamental technique and by reducing to habit and to "graphic language" the fundamental art norms, the desirability of having reliable standards and norms becomes apparent.

QUESTIONS AND EXERCISES

1. What is meant by the idea that drawing is a form of expression?
2. List situations in school work in which the ability to draw functions.
3. What is meant by a "preconceived purpose" in drawing?
4. What factors enter into the ability to see?
5. List methods the teacher may use in motivating the drawing work.

---

[1] Kline, L. W., and Carey, Gertrude L. *Op. cit.*, p. 56.

6. If a class of children is available, secure drawing specimens and score them according to Miss Goodenough's method (see reference).

7. List methods of providing for children of inferior and superior drawing ability.

8. Of what value is a psychological analysis of drawing ability?

9. What social needs are met by drawing?

10. Visit a drawing class and list all the ways in which the teacher relates the work in drawing to other school work. How does she provide for individual differences? How is the work motivated?

SELECTED REFERENCES

1. Ayer, F. C. *The Psychology of Drawing.* Warwick & York, Inc. 1916.
2. Ayer, F. C. "Present Status of Instruction in Drawing with Respect to Scientific Investigation," *The Eighteenth Yearbook of the National Society for the Study of Education*, Part II, Chap. V. Public School Publishing Company. 1925.
3. Dewey, John. "The Psychology of Drawing," *Teachers College Bulletin*, Tenth Series, No. 10. March 1, 1919.
4. Freeman, F. N. *The Psychology of the Common Branches*, Chap. III. Houghton Mifflin Company. 1916.
5. Farnum, R. B. "Present Status of Drawing and Art in the Elementary and Secondary Schools of the United States," *United States Bureau of Education*, Bulletin No. 13. 1914.
6. Goodenough, Florence L. *Measurement of Intelligence by Drawings.* World Book Company. 1926.

7. Hollingworth, Leta S. *Special Talents and Defects*, Chap. VII. The Macmillan Company. 1923.
8. Kline, L. W., and Carey, Gertrude L. "A Scale for Measuring Freehand Drawing," Johns Hopkins University *Studies in Education*. 1922.
9. Manuel, H. T. *Talent in Drawing*. Public School Publishing Co. 1919.
10. McCarty, Stella A. *Children's Drawings: A Study of Interests and Abilities*. Williams and Wilkins Co. 1924.
11. Meier, N. C. "Aesthetic Judgment as a Measure of Art Talent," *University of Iowa Studies*, Vol. I, No. 19. August 1, 1926.
12. Thorndike, E. L. "Measurement of Achievement in Drawing," *Teachers College Record*, Columbia University, pp. 345–382. November, 1913.

CHAPTER XXIII

THE PSYCHOLOGY OF MUSIC

Aim of music education. The aims of music education are to be determined by the needs of the individual for his own growth both as an individual and as a member of the social group. The individual point of view and the social point of view probably are but different aspects of the same thing. The needs of the child as a member of society change somewhat with each generation because society itself is not static. The production of music in the local community is not so important as formerly, because a much greater variety of music is now available from outside sources than ever before. This changed condition has given additional importance to the necessity for training in information and interest out of which an appreciation for good music may grow.

Bobbitt[1] after an analysis of the needs of community life lists the following objectives of musical training:

Objectives of Music

A. In the basic training:
  1. Ability to utilize music for a healthful, varied, and abundant awakening of one's emotional nature.
  2. Ability to sing.

---

[1] Bobbitt, Franklin. *How to Make a Curriculum,* pp. 232, 233. Used by permission of, and arrangement with, Houghton Mifflin Company.

3. A proportioned intellectual apprehension, such as one's natural capacity will permit, of the realities which make up the world of man's life : the world of sound and music.
4. Ability to make one's various mental and emotional states and activities contribute in maximum degree to one's physical well-being.
5. Ability to relax physically and mentally at proper times and in proper ways.

B. Additional, when an "extra."

1. High-grade amateur vocal ability.
2. Ability to play a musical instrument.
3. Technical understanding of music.

Music a form of expression. The production, interpretation, and appreciation of music, when considered from the viewpoint of development, widen the individual's range of expression. The world of the child is limited to those things to which he is able to respond. Music is an important part of the child's potential social heredity. His development is conditioned by that part of his social heredity in which he is able to function. Education as a process or an end is no longer considered merely as "securing knowledge or acquiring information." The functional point of view emphasizes the value of the subject matter of the school in the development of the individual both for his own sake as a personality and as a member of society. Music opens up an important part of the child's environment and provides additional opportunities for adjustment or expression.

Abilities functioning in musical education. Efficiency in any program of training would seem to demand that a psychological analysis be made of the function to be developed. Musical education consists in the training of many special abilities which function in a complex whole. Seashore has probably made the most valuable contribution to the psychology of music. He made a twofold classification in taking an inventory of the musical mind. The first is concerned with those attributes of sound — pitch, intensity, duration, and extensity — which the individual is able to distinguish. The second classification is concerned with a list of the abilities which are used in connection with the four attributes of sound just mentioned. Seashore[1] gives the following list of factors as entering into the musical mind:

I. Musical sensitivity
  A. Simple forms of impression
    1. Sense of pitch
    2. Sense of intensity
    3. Sense of time
    4. Sense of extensity

  B. Complex forms of appreciation
    1. Sense of rhythm
    2. Sense of timbre
    3. Sense of consonance
    4. Sense of volume

---

[1] Seashore, C. E. *The Psychology of Musical Talent*, pp. 7, 8. Silver, Burdett and Company. 1919.

II. Musical action

Natural capacity for skill in accurate and musically expressive production of tones (vocal, instrumental, or both) in:

1. Control of pitch
2. Control of intensity
3. Control of time
4. Control of rhythm
5. Control of timbre
6. Control of volume

III. Musical memory and imagination

1. Auditory imagery
2. Motor imagery
3. Creative imagination
4. Memory span
5. Learning power

IV. Musical intellect

1. Musical free association
2. Musical power of reflection
3. General intelligence

V. Musical feeling

1. Musical taste
2. Emotional reaction to music
3. Emotional self-expression in music

In making any classification of abilities such as the one just given, it must be remembered that it is made purely for purposes of convenience in study. Modern psychology does not regard the individual's mental ability as composed of a number of separate faculties, one of which functions in this situation and another in that. The individual is always in action as a whole. Movement, feeling, thinking, and all other aspects of human behavior which might be named for purposes of convenience in study are always present in every reaction the individual makes.

What is meant by appreciation? Appreciation has its genesis both in the emotional and intellectual life of the child. It would be contrary to the facts of modern psychology to suppose that appreciation is developed in the same way in all children or that it has the same foundations in each individual. Every reaction an individual makes may be considered from many points of view. To the same or approximately the same situation pupils will react with characteristic differences. Different situations call for different reactions. A word spoken in the dark will be interpreted in terms of the meaning it conveys. A moan or sob under similar conditions will be given meaning by the hearer. In these two instances the meanings may be interpreted in terms of words, but it is possible that the emotional aspects of the individual's response may dominate. So it is with music: the condition of the hearer will determine the response. For one individual appreciation may be largely intellectual, consisting of meanings and interpretations. For another it may be largely emotional, consisting of feelings and aesthetic enjoyment.

The school, in its attempt to broaden the intellectual interests of the child, has probably neglected the emotional training of the individual. The feelings develop out of original tendencies to react with specific emotional states just as the motor responses and intellectual life of the child grow out of certain original and early acquired traits. If, out of more primitive ones, knowledges and skills which make for a higher level of living can be developed by the school, certainly more primitive states of feeling, which are present in every reaction made by the individual, may be improved. This improvement or development of appreciation should affect the entire life of the individual and thus raise the general level of living in that sphere. Appreciation of music is not to be thought of merely in terms of content. The chief element in the appreciation of music has to do with those feelings and attitudes which are developed in connection with the beautiful.

The inheritance of musical ability. It is pretty generally conceded that musical ability is not closely correlated with mental ability as measured by tests. It seems to be a more or less special ability whose inheritance is not necessarily associated with the inheritance of mental ability. As previously stated, there are a number of more elementary abilities, such as sense of pitch, which enter into the complex called musical ability. From what we know of the laws of heredity and from results secured by measurements, it seems likely that these more elementary musical abilities are not linked in inheritance. This being the case any one of them or any combination of them might be inherited by an individual from his ancestry.

Musical ability as a rule seems to run in families. One of the most noted families the members of which almost all possessed musical ability to an unusual degree was the celebrated Bach family. This family came from capable Thuringian peasant ancestry. In only six generations, fifty-seven musicians appeared. Of this number, twenty-seven were said to possess musical ability to a remarkable degree. Occasionally, a child is discovered who develops into a musician although no member of his immediate ancestry has shown evidence of special ability. This may be explained by the fact that there are probably many persons of talent who are never placed in an environment favorable for the development of that talent. The offspring of such a person may find just the right conditions for the development of the talent inherited from his parents. Again, individuals inherit traits from many lines of ancestry. It is conceivable that a person might inherit one trait from one line, a second from another, and so on, and thus secure a combination of abilities which would make it possible for the individual to develop as a musician much above the average. From what we know of the laws of heredity this is exactly what we would expect to happen occasionally.

Motivating the learner. The music period is enjoyed by most pupils. It affords a change in sharp contrast to the regular routine of school work. The fact that it does involve a different type of activity gives the music teacher a decided advantage in securing the interest of all the pupils. Most individuals like variety in their work and enter into the new activity with a considerable amount of zest.

The music period possesses another advantage over most school work. Because of the nature of the subject, opportunity is provided for a great amount of activity. The entire group is able to participate in the work of the class thus giving added interest and enthusiasm.

An additional incentive for learning is provided through programs furnished by the group for the school or community. There are many special occasions which offer opportunities for definite training with definite ends in view. The teacher must not become engrossed in more or less incidental matters; yet if she is able to keep the aims of musical education in view and still take advantage of the stimulus which comes from group activities in audience situations a powerful incentive is furnished for learning.

Can a sense of rhythm be developed? Rhythm is an important factor in music but in itself is not music. Many teachers with little knowledge of psychology feel that the child's musical education should be approached through rhythm. There are certain advantages to be gained in the early grades by rhythm practice, but it should be understood that this is not training in music. Practice probably does help in the development of certain motor skills which are associated with rhythm. It is very questionable whether practice in rhythm strengthens that ability. Several studies have been made in which little or no positive results of training were found. Klauer[1] studied the effect of training upon the sense of rhythm. She gave the Seashore Rhythm Test to seventy-five children in the fourth, fifth, and sixth grades. After this she gave drills in rhythm during a period of two months. At the end of this time the tests were given again. She found an average gain of only 3.4 per cent in the second set of scores over the first. In order to determine whether this difference was due to the rhythmic drills or to practice in taking the test, it was later given to seventy-five additional pupils. Practically the same gain was found between the last two tests as between the first two. This tends to show that the gain in the second test after drill was not due to the drills but to practice in taking tests. Other investigations made at the State University of Iowa have tended to confirm the view that a sense of rhythm is innate and not a result of training.

Individual needs. The teacher of music has a more difficult task in attempting to adapt instruction to the individual needs of the pupils than has the teacher of the more formal subjects. Children are promoted from grade to grade on the basis of mental ability and achievement in the formal subjects with little or no reference to musical ability and achievement in music. Since little relationship is generally found between mental ability, which is usually closely correlated with achievement in the formal school subjects, and musical ability, which is correlated only to a slight degree with these, the pupils of a given grade, as a rule, vary over a wider range of abilities in music than in almost any other school subject. This makes the teaching of music to regularly organized school groups a very difficult task. In almost any grade there may be found pupils who possess all degrees of ability from almost none to fair or even superior ability. Not only is this true but in the higher elementary grades will be found individuals with changing voices who add to the difficulty already stated. The music teacher has not only the most difficult ability grouping in the school, but usually is able to devote relatively such a small amount of time to music instruction in a grade that she is unable to study the individual abilities and needs of the pupils.

---

[1] Klauer, Naomi. "The Effect of Training in Rhythm upon Rhythmic Discrimination in the Intermediate Grades," *Thesis*, State University of Iowa, Iowa City, Iowa.

In music, as elsewhere in school, the nature and type of instruction should be determined by the needs of the individual. This principle would demand a regrouping of pupils for purposes of instruction. Pupils in the elementary grades may usually be grouped under one of three heads: those with little musical ability, those with fair ability, and those with more than average ability. In addition to these three groups, individuals with changed or changing voices are to be found in the upper grades. As far as musical ability is concerned the situation here is analogous to one in which the teacher of arithmetic in a grade, say the sixth, is compelled to teach pupils ranging in mental ability from morons to near genius. In providing for individual needs the grade divisions of the school should be largely disregarded. Pupils from several grades who have similar degrees of ability in music may be brought together for instruction. It is necessary that materials be provided to suit the ability of the group instructed.

The aim of the teacher will determine the methods to be used to meet individual needs. The development of the ability to sing will require treatment different from the development of music appreciation. For the latter, hearing good music which can be at least partly understood is essential. For this reason all pupils should be given opportunities of hearing the best pupils of the school as well as outside talent.

Tests of musical ability. There are a number of tests available for the measurement of various phases of musical ability. For purposes of determining the capacity of an individual to learn music the Seashore[1] tests are probably the best. They have been placed on phonograph records and may be played on almost any phonograph, thus providing a test which may be given to a fairly large group of children at the same time. Each pupil is provided with blanks on which he records his judgments as he takes the test. He is tested on his ability to make the following discriminations:

---

[1] Seashore, C. E. *The Psychology of Musical Talent.* Silver, Burdett and Company. 1919.

1. Pitch discrimination. Seashore thinks that his test measures innate ability in pitch discrimination. He states that this trait cannot be improved by practice to any appreciable degree. The ability is measured by having the subject compare the pitch of two tones. Gradually the difference in pitch is decreased until no difference may be discerned. The number of correct responses constitutes the pupil's score.

2. Intensity of sound. In this case the directions state that tones will be given which differ in intensity. The pupil records S if the second is stronger and W if it is weaker. The difference between the two in intensity is generally decreased. The correct responses again constitute the score. Seashore believes that this trait also is innate and not affected by training.

3. Sense of time. In this test the subject judges as to the length of two intervals of time. The procedure is approximately the same as that for the two preceding tests.

4. Consonance. In this test the subject hears two combinations of two tones. He is to judge which combination is better or worse than the other in consonance.

5. Memory for tones. Here a series of tones is played twice. In the second playing one of the notes is changed. The subject is to count mentally in both playings so that the changed note may be identified.

6. Sense of rhythm. This test consists in the comparison of a series of rhythmic patterns to determine whether they are the same or different.

The Seashore tests are probably valuable for purposes of testing musical ability. If so, the value of the tests must be great. When we think of the enormous loss of time and money involved in attempting to teach pupils who do not have the ability to profit by teaching, we realize the value of such tests as these. In no phase of education probably is the waste greater than in musical education. Large sums of money and much time is lost through the effort to teach individuals to produce music when those individuals do not have the capacity to acquire skill as producers. The tests should be of advantage also in selecting individuals who do possess the innate abilities upon which musical training rests. If the tests serve in helping society discover and develop the latent talent which it possesses, they will have contributed much to scientific education.

Figures 10 and 11 present two talent charts after Seashore.[1] In discussing the individual whose abilities are pictured in Figure 10, Seashore says:

> Mr. White's sense of pitch is superior; his sense of intensity is good; his sense of time is excellent. His sense of consonance is superior. His acuity of hearing is also superior. He has good tonal imagery and superior tonal memory. His general motility, timed action, and rhythmic action are quite good. He has superior capacity for singing in pitch, sings intervals well, and has good voice control for pitch. He has a superior register and good quality of voice.
>
> In general, Mr. White has an unusually strong and well-balanced musical mind, ranking in this respect within the best three per cent in a normal community. He has always manifested great interest and activity in music, but has

---

[1] Seashore, C. E. *Op. cit.*, pp. 23–25.

FIGURE 10. TALENT CHART OF MR. WHITE[1]

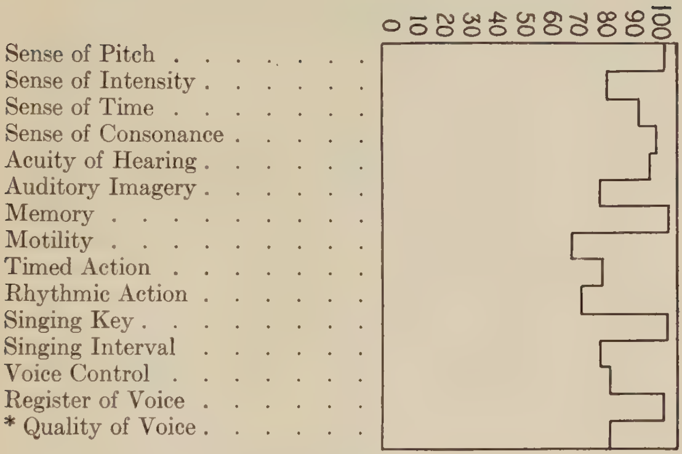
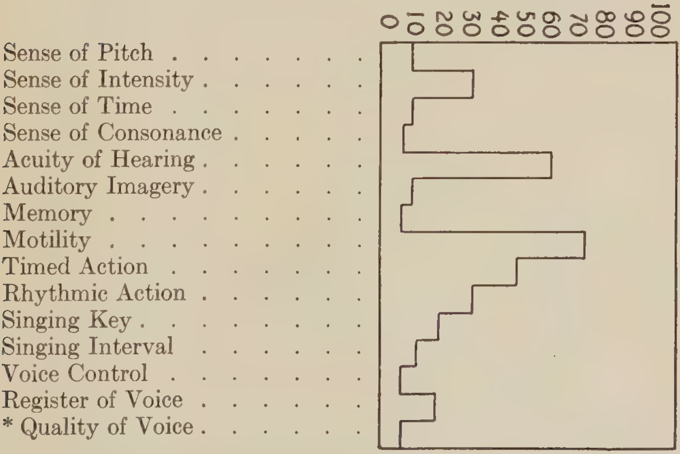


FIGURE 11. TALENT CHART OF MR. BLACK[2]



* The items marked with an asterisk in the charts represent mere estimates in the absence of norms.

---

[1] Seashore, C. E. *Op. cit.*, pp. 23 and 24.

[2] *Ibid.*

had only a small amount of formal training. He lives in a tonal world and is emotionally responsive to music.

With regard to the individual whose abilities are pictured in Figure 11, Seashore says:

> Mr. Black is decidedly inferior in all the basic capacities for music. The three capacities in which he ranks best — general motility, acuity of hearing, and timed action — are therefore of scant musical significance. So far as musical resources are concerned, his record is remarkable for its uniform inferiority. He has taken music lessons but has met with failure. He shows a perfunctory interest in music. This record removes all necessity for uncertainty and pretense.

QUESTIONS AND EXERCISES

1. Define rhythm. Show how rhythm functions in various social situations. How is rhythm related to the early development of music?
2. What is a monotone? How would you detect a monotone?
3. How is music related to reading? Arithmetic? Social science? Health?
4. List the factors necessary for success in music. Which of these are not influenced to any large extent by training?
5. Compare the social needs of a community for the local production of music at the present time with the needs of a decade ago.
6. Elaborate the idea that music widens the child's environment.
7. Discuss this problem: How the condition of the hearer influences the appreciation of music.

8. If there is a family of your acquaintance in which there are members who possess more than average musical ability, try to make a chart showing how this ability was inherited.

9. Study the children of a school grade. Do those possessing musical ability come from musical homes?

10. Visit a class during the music period. Suggest ways of motivating the work of the grade.

11. Try to analyze what the appreciation of music means to you. What do you get out of music?

SELECTED REFERENCES

1. Freeman, F. N. *The Psychology of the Common Branches*, Chap. V. Houghton Mifflin Company. 1916.
2. Gaw, E. A. "A Survey of Musical Talent in a Music School," *Psychological Monographs*, No. 8. *University of Iowa Studies.* 1922.
3. Miller, D. C. *The Science of Musical Sounds.* The Macmillan Company. 1926.
4. Schoen, Max. *The Effects of Music.* Harcourt, Brace and Company, Inc. 1927.
5. Seashore, C. E. "The Rôle of a Consulting Supervisor in Music," *The Eighteenth Yearbook of the National Society for the Study of Education*, Part II, Chap. VI. Public School Publishing Company. 1925.
6. Seashore, C. E. "A Survey of Musical Talent in the Public Schools," *University of Iowa Studies in Child Welfare*, Vol. I, No. 2. August 20, 1920.
7. Seashore, C. E. *The Psychology of Musical Talent.* Silver, Burdett and Company. 1919.
8. Stanton, H. M. "The Inheritance of Special Musical Capacities," *Psychological Monographs*, No. 8. *University of Iowa Studies.* 1922.

CHAPTER XXIV

THE PSYCHOLOGY OF THE SOCIAL STUDIES

History and geography are courses of long standing in our schools. Civics was introduced just prior to and immediately following the period of the Civil War in order to give the pupils a better acquaintance with the constitution of their state and that of the United States. The texts in history published just after the Civil War show that a strong nationalistic spirit was being awakened. History became an important study in the curriculum from the elementary school through the graduate school. In a short time it was being required for entrance by most colleges and universities. A study of the aims given for the teaching of history, geography, and civics shows that the aims at the beginning of the nineteenth century are not unlike those advocated today by the teachers of these subjects. The major difference in the aims of that period and this is that less emphasis is being given at present to the disciplinarian value of the subject and more to the utilitarian, together with emphasis on the value of these subjects in the making of better citizens. The aim receiving most attention today in the teaching of the social studies is training for citizenship.

Several movements led by those interested in the various phases of the social studies, as well as by students of education in general, explain to a large extent the fact that one hears much today concerning the teaching of the social studies rather than the teaching of the individual subjects. In 1859 Herbert Spencer pleaded for a common course which he designated "Descriptive Sociology." In his essay entitled "What Knowledge Is of Most Worth," he lists different kinds of materials which should be studied by the child in order that he might be ready for complete living. This early emphasis on the social studies, followed by the industrial transformation in America during the latter part of the nineteenth century, awakened the leaders of education to a broader conception of the aims for the teaching of the social studies.

Dewey [1] appeared in American education as a new interpreter of its aims and principles. His emphasis is that of social efficiency. His concept of the relation between the child and the work of the school is that of activity rather than passivity. He emphasized the point of view that the child should be given opportunity and stimulation to carry on the types of activities which are necessary for the making of good citizens. Concerning Dewey's philosophy, Rugg [2] quotes the following excerpt from Cubberley,[3] "Education, therefore, in Dewey's conception, involves not merely learning, but play, construction, use of tools, contact with nature, expression, and activity, and the school should be a place where children are working rather than listening, learning life by living life, and becoming acquainted with social institutions and industrial processes by studying them." Dewey's emphasis on child activity and its relation to real life situations awakened a new concept of the methods of education as related to child activity. The relation between the child and his teachers has been misinterpreted by many teachers who see in Dewey's philosophy a theory of absolute freedom and who, following this conception, set out to build up their own theory and practice on the basis of this interpretation. This doctrine of child activity in the work of the school must not be thought of as activity that is entirely undirected. The teacher's duty is not only to help the child in his choice of an activity, but she should to an extent guide him in carrying out the activity. This phase of the social studies will be considered later in connection with some of the more effective methods employed in supervised study.

---

[1] Dewey, John. *The Child and the Curriculum.* University of Chicago Press. 1902.

[2] Rugg, Earle. *The Twenty-Second Yearbook of the National Society for the Study of Education*, Part II, p. 69. 1923.

[3] Cubberley, E. P. *Public Education in the United States*, p. 360. By permission of, and arrangement with, Houghton Mifflin Company, 1919.

Another factor which affected the social studies and stimulated further interest was the entrance of America into the World War in 1917. The government at once felt the value of and the necessity for a true nationalistic spirit and published various pamphlets and programs concerning community life, food conservation, economy, farming, etc. This material was often presented in a vivid manner through graphs and illustrative descriptions. People in general became interested in peoples of other lands, their mode of living, customs, travels; political events; and in other topics that are usually treated in the social studies.

Aims for teaching the social studies. Recent years have brought about an insistent demand that history, geography, and civics be so organized as to make a more definite contribution to the field of training for citizenship. In a democracy where vital problems arise from time to time and where a majority vote of the citizenship is considered the factor to settle these problems, it becomes highly important that the citizens be prepared to meet adequately the demands made on them by their industrial, social, and political life. It is an observed fact that people seldom deliberate to any noticeable extent on the problems of today. Rugg[1] says:

> In politics, for example, we do not weigh values; we vote bond issues. Predispositions caused by party affiliations and ancestral prejudices determine our reaction to the question of revising the tariff upward. The plumber who repairs my furnace, and my neighbor, the coal company owner across the street, respond to question of wages, hours, or ownership of utilities on exactly the same bases — those of impulse and predisposition. Seldom are the facts of such situations reviewed, and rarely are actions upon them determined by deliberate judgment.

---

[1] Rugg, H. O. *The Twenty-Second Yearbook of the National Society for the Study of Education*, Part II, p. 1. 1923.

Society expects the social studies to give the growing citizen knowledges and habits that are of value in solving the problems he will face in the future. In the social studies the student learns of various modes of living and becomes acquainted with accepted standards of behavior. These studies should give pupils a fuller and more sympathetic understanding of other peoples. They should aid the student in understanding the complex relation every type of business has in fitting into the economic activity of today. Here knowledge should be obtained of contemporary life and of how the problems of the state, country, and nation came to be what they are. Students in the social studies should not only acquire knowledge and skill but also habits of group work, knowledge of how groups form judgments, notions concerning the rights of others, and so on; all of which are based on habits that should be developed in the making of better citizens.

Methods of selecting the materials of instruction in the social studies. The method most commonly used in selecting the materials to be taught in the social studies is the committee method. In this method a committee composed of persons who are considered authorities in the field meet and draw up a course. The method is open to several criticisms: (1) the material is not selected on a scientific basis but purely on the basis of opinion; (2) the materials are usually not selected in accordance with the child's past experience, present interests, nor his psychic development; (3) the materials selected are often in line with the interests of the committee and probably far removed from present-day activities and problems, as well as from the needs and interests of the child; (4) the materials are poorly graded with respect to their place in the curriculum. The investigations[1] by Washburne, Bassett, and Bagley have shown rather conclusively that the activities which are used most in life are not those furthest removed from present industrial, social, and political problems.

As a contrast to the committee method of selecting materials the scientific or objective might be cited. This method attempts to overcome the criticisms made against the former. In the latter method journals and papers are studied during a period of time for the purpose of finding out what topics are being discussed. From this study the curriculum builder is able to determine what materials should be taught in order to aid pupils to participate intelligently in the solution of present-day problems. This method of selecting materials also has several obvious defects unless wisely used. Those often pointed out are: the topics most frequently discussed may not be of great importance for the making of good citizens; political factors and temporary as well as local conditions largely affect the civic duties of citizens and it is very difficult to pick out, with any degree of assurance, specific situations for the development of social abilities, attitudes, and ideals.

---

[1] *The Seventeenth Yearbook of the National Society for the Study of Education*, Part I.

Difficulties in teaching the social studies. The most fundamental factor in the teaching of any subject is a knowledge of that subject. It is not enough that the teacher understand the laws of learning and the psychological principles involved in human behavior, but he must have a good technique for presenting materials; he must also know the materials which are to be taught. This means that the teacher must be alive to the social, economic, and civic problems of the present. Furthermore, the problems of the present must be related to those of the past. This necessitates not only a keen awareness of present problems but also a knowledge of their historic background.

There are other difficulties which make teaching and learning difficult in the field of the social studies. Probably no other part of the recitation is so important as the assignment. A clear, definite assignment is essential to efficient learning. It is more difficult to make such an assignment in the social studies than in many fields because the materials are not so well selected and organized. Again, in dealing with the elementary skills developed through practice in the tool subjects, the teacher knows what should be the result of each assignment and is able to check the learning of the pupil. In the field of the social studies, where social points of view and attitudes are being developed, it is much more difficult to plan a lesson or group of lessons so as to secure certain definite outcomes. It is also harder to check the learning.

Directed study in the social studies. In the preceding paragraph the importance of the assignment was mentioned. The social studies are of such a nature that a wide range of materials is involved. In this field it is much harder to fix limits to problems and projects than it is in most others. For this reason the assignment in the social studies becomes doubly important. It is needless to state that the assignment should be as definite as it is possible to make it. From the assignment pupils should get: (1) the kind of study expected of them; (2) the nature of the materials to be used; (3) a knowledge of the purpose for which they are to work and what they are expected to accomplish; and (4) proper motivation.

In supervised study the materials with which children work often determine whether the project is a success or failure from the point of view of learning. In the beginning, children should certainly take up subjects that are in their immediate environment, subjects that they know most about and are the most interested in, and subjects that can be made concrete and to which comparisons may be made.

In practically all communities there are opportunities to study events and projects which will lead to larger and larger projects and which are of great interest and value to the pupils. A knowledge of how people formerly responded to their environment and of social, political, and economic conditions can well be secured by studying the early settlement of almost any community. What kinds of homes did the early settlers build? Why did they build at certain places? Under what conditions did they live? A study like this is valuable in that it provides a concrete approach to problems and conditions of today. In dealing with the social studies it is unnecessary to use imaginative topics and theoretical situations. Children are much more able to grasp fundamental issues met by the average citizen when these issues may be compared to concrete conditions. Theoretical problems should not be used unless there is some special reason for doing so, and generally there is not. Neither is it necessary to go very far from home to find situations which raise all the fundamental problems of a democracy.

Mental processes involved in the social studies. In learning to read and write, the child deals with materials which are concrete and which are immediately present. Later his reading and writing in the process of thought getting may take him beyond his immediate experience. Much of the material presented in history and geography carries the child beyond the point which he has actually experienced. In history, for example, the child through his readings may be carried back to the days of the Greeks and he may study their customs and manner of living; or he may study the lives of the early colonial settlers of North America. In both cases the materials are concerned with experiences which are remote in terms of time. In geography, on the other hand, the child learns about places and peoples widely separated in terms of space. We use the term *im-*

agination when we are trying to picture to ourselves events and conditions beyond our physical environment. Memory and learning, as well as other so-called mental processes, are factors in all our experiences dealing with events which are remote in either time or space.

Language habits are important for the social studies. They not only make possible delayed responses but many ideas are of such a nature that the individual seldom thinks of them in connection with a definite object or place. "Good citizenship," for example, is a term used to denote a whole system of ideas and habits possessed by the persons of a country. These words are the embodiment of certain ideas and they convey specific meanings. The value of the part language plays in imagination and other mental processes cannot be too much emphasized in the social studies. Much of the material in the social studies is composed of ideas concerning economic life and social relationships. These ideas are expressed in language which summarizes a variety of different situations and conditions and which appears to make them more definite.

What historical content should be used in the grades? In considering the content of an historical nature for the social studies, the major problem is to locate the materials which will meet the aims generally agreed upon. When selecting content which will aid in developing specific attitudes one finds a mass of opinion but little of an objective character which will be of aid. The development of certain specific attitudes is usually listed as an aim of the social studies. Because of the difficulties encountered in doing research regarding the selection of content which will aid in the development of these attitudes, this phase of the study of content has been largely neglected.

TABLE LXXX. REFERENCES TO PERSONS IN BOOKS AND ENCYCLOPEDIA ARTICLES COMBINED (AFTER HORN)

1.	Roosevelt	284	16.	Grant, U. S.	18
2.	Smith, Adam	214	17.	Pitt, Wm.	16
3.	Mill, J. S.	174	18.	Wells, H. G.	16
4.	Malthus	74	19.	Gladstone	16
5.	Napoleon	64	20.	Wagner, A.	15
6.	Marx, Karl	59	21.	Webb	14
7.	Owen, Robert	44	22.	La Salle	14
8.	Gompers	41	23.	Napoleon III	12
9.	Ricardo	38	24.	William III	10
10.	Wilson	30	25.	Gallatin	10
11.	Washington	29	26.	Jackson, A.	10
12.	Louis XIV	29	27.	Montaine	10
13.	Rousseau	26	28.	Hamilton, A.	9
14.	George, Henry	25	29.	Wright, C. D.	7
15.	Jefferson, Thos.	24	30.	Shaw, Bernard	6

Horn[1] conducted an investigation to determine what persons were most frequently mentioned in twenty-seven books and articles dealing with modern social and economic problems. His data are given in Table LXXX. This table gives the ranking of a number of men as to frequency of mention. Horn also investigated the frequency of dates. He found that a number of dates which are almost always taught were seldom mentioned in books and articles. All the investigations show a need for a more objective method of selecting and evaluating material for the social studies.

---

[1] Horn, Ernest. *The Sixteenth Yearbook of the National Society for the Study of Education,* Part I, p. 165. 1917.

Provisions for individual differences in the social studies. The social studies, if taught in a manner related to the experiences of the pupils, do not involve so much of the abstract. In any school grade there is a wide range of abilities represented. The fields of the social studies are so broad and the problems so diverse that they present ample opportunities for the alert teacher to provide activities suitable to the interests and abilities of every child. Children need not use the same material to attain the same aims. Those of greater ability are able to work at a higher level than those of lower ability, but certain fundamental ideals and attitudes may be developed through the work of each group.

The aim of education should never be to make all children alike, yet there are attitudes and habits of good citizenship which should be developed in each pupil. In this respect the school seeks to make children more alike. Respect for the rule of the majority, tolerance, open-mindedness, honesty, regard for the rights of the public, a sympathetic understanding of peoples of other lands, and similar attitudes are habits in which each may differ somewhat but which are fundamental for social life.

Measurement in the social studies. A number of tests have been devised for history, civics, and geography, the studies which are generally listed as the social sciences. While there has been much constructive work done on the curriculum for an integrated course in the social studies, little has been done in the field of testing. As the materials of instruction are better organized and selected, there is a great need for tests which will measure the results of learning and which will aid in determining whether specific materials for learning lead to the desired objectives.

The Kepner Background in the Social Sciences[1] is probably the best example of a test constructed to inventory the information which pupils bring to school. The tests, however, were constructed for the secondary school and are therefore hardly applicable to the elementary grades. The tests consist of seven exercises and appear to be well standardized. The writers found a coefficient of reliability of .83 between Forms A and B for a group of 71 tenth-grade pupils.

Examples from the seven exercises are reproduced here because they illustrate methods of testing which elementary teachers might profitably follow.

EXERCISE I

In each of the sentences below you are given four choices for the last word. Only one is the correct word. In each sentence draw a line under the correct word.

1. The Pilgrims came in a ship called the Pinta
   Half-Moon Mayflower Plymouth Rock

---

[1] Kepner, Tyler. "The Harvard Tests, Background in the Social Sciences." Ginn and Company. 1924.

2. A period of one hundred years is called a Generation
Fortnight   Decade   Century

14. Soviet Russia was organized under the leadership of
Sun Yat-Sen   Tolstoy   Romanov   Lenin

Exercise II

In each of the sentences below you are given four choices for the last word. Only one is the correct one. Under each sentence draw a line under the correct word as you did in Exercise I.

1. "Uncle Tom's Cabin" is a description of life among
Savages   Criminals   Slaves   Soldiers

7. "Pilgrim's Progress" is the story of the experience of a Robber Baron   Christian   New England Pilgrim   Feudal Lord

Exercise III

In the sentences below one and sometimes two words are omitted. In each case write the proper word or words in the blank space or spaces so as to complete the sentences accurately.

1. Traveling from New York to London you would cross the —— Ocean.

13. Distance on the earth's surface measured north and south is called ——.

Exercise IV

Examine carefully the words and phrases that follow and indicate the correct phrase with a mark ×.

1. The League of Nations is an attempt to
—— crush Japan
—— abolish all monarchies
—— form a family of nations

12. Imperialism is the desire of a country to
—— unite the people of one race and speech in one nation
—— be a member of the family of nations
—— expand or add to its land possessions

Exercise V

In this exercise read the descriptions carefully and in the list of words given at the bottom of the page find the word which is described. When you have found the word, write it in the blank space opposite the description.

1. Chief executive or official of the United States government ——

15. Office holders chosen for political reasons ——

List of Words

1. Congress
5. Spoils System
9. President
12. Budget

Exercise VI

In the following exercises indicate the time order in which each took place (held office, lived, etc.), by placing the figure 1 before the event which took place first, the figure 2 before the event which took place second, and so on through the five events. The first one is done.

1. Presidents	4. Amendments to the Constitution (Order in which added)
5 Taft	——Direct Election of Senators
1 Monroe	——Woman Suffrage
2 Jackson	——Abolition of Slavery
4 McKinley	——National Prohibition
3 Cleveland	——Voting Rights to Negroes

EXERCISE VII

In the following exercises a list of dates is given at one side of each exercise, and at the other side there are blank spaces. A date is to be taken from one side and put in the proper blank space at the other side for each event. The first one is done, showing how dates are selected from the left side and put in their proper spaces on the right side.

1. Events
1914 Landing of the Pilgrims...............1620
1607 End of Civil War.....................1865
1898 Jamestown founded...................1607
1865 World War begun.....................1914
1620 Spanish-American War...............1898

6. Events
1781 Albany Congress.....................——
1619 Stamp Act Congress..................——
1765 First Continental Congress...........——
1754 Articles of Confederation.............——
1774 Representative government to Virginia..——

The Kepner Test is not a time test. It probably emphasizes historical material to the exclusion of other materials from the social studies. We do not know at present just what facts should be stressed in such a test because the courses in the social sciences are in the making. A good diagnostic test in the social studies should include much more material than is included in the Kepner test. However, as a test it appears to do well what it is supposed to do, namely, sample the information which secondary school pupils bring to school.

QUESTIONS AND EXERCISES

1. What activities may be employed in developing habits and attitudes of good citizenship?

2. List five topics that are suitable for the social studies in the early grades.

3. What has been the recent trend with respect to the teaching of history? Geography? Civics?

4. Differentiate imagination as used in geography and in history.

5. What is a project? Why are the social studies so well adapted to large units of study?

6. When should the social studies be introduced into the curriculum? Why?

7. What is the committee method of determining the content belonging in a course of study for one of the social sciences? Name the defects of this method.

8. Review critically the current topics of a recent number of the *Literary Digest*. What type of geography and history would be most valuable to you in a further understanding of some of the topics? Give specific illustrations.

9. Examine a text in geography, one in history, and one in civics for the purpose of noting the materials common to any two or to all three. Since the aims of the three fields are so largely the same, why are they so commonly separated and taught as different subjects?

10. Select a topic in the social studies and work out an assignment for a supervised study period.

11. Devise an objective examination for a project in the social studies.

12. Outline a project dealing with some local character or event. Show how you would develop the project so that the pupils would see the relation of the character or event to larger events.

SELECTED REFERENCES

1. "Report of the Committee of Eight on the Study of History in the Elementary School," *The American Historical Association.* Scribner's. 1909.
2. "Tentative Report on the Teaching of Sociology in the Grade and High Schools of America," American Sociological Society. *The School Review.*
3. Ayer, Adelaide M. "Some Difficulties in Elementary School History," Teachers College, Columbia University, *Contributions to Education,* No. 212. 1926.
4. Bagley, W. C. "The Determination of Minimum Essentials in Elementary Geography and History," *The Fourteenth Yearbook of the National Society for the Study of Education,* Part I, pp. 131–146. 1915.
5. Bassett, B. B. "Historical Information Essential for the Intellectual Understanding of Civic Problems," *The Seventeenth Yearbook of the National Society for the Study of Education.* 1918.
6. Bourne, H. E. *The Teaching of History and Civics in Elementary and Secondary Schools.* Longmans, Green and Company. 1907.
7. Brooks, Eugene C. *Education for Democracy.* Rand, McNally and Company. 1918.
8. Cabot, Ella Lyman. *A Course in Citizenship.* Houghton Mifflin Company. 1910.
9. Cabot, Ella Lyman. *Ethics for Children.* Houghton Mifflin Company. 1910.
10. Clark, Edith M. "The History Curriculum Since 1850," *The Historical Outlook,* Vol. XI, pp. 58–68.
11. Dunn, A. W. "Civic Training through Service," *United States Bureau of Education, Teachers Leaflet* No. 8. 1920.

12. FORBES, MILDRED P. *Good Citizenship through Story-Telling.* The Macmillan Company. 1923.
13. GAMBRILL, J. M. *Experimental Curriculum-Making in the Social Studies.* McKinley Publishing Company. 1924.
14. HATCH, R. W. *Projects in Citizenship.* Citizenship Company, Leonia, N. J. 1923.
15. HOLTZ, F. L. *Principles and Methods of Teaching Geography.* The Macmillan Company. 1921.
16. HORN, E. C. "The Application of Scientific Method to Making the Course of Study in Civics," *The Elementary School Journal*, Vol. XIX, pp. 762–777.
17. JOHNSON, H. *The Teaching of History in Elementary and Secondary Schools.* The Macmillan Company. 1916.
18. *The National Society for the Study of Education, Twenty-Second Yearbook*, Part II. 1923.
19. PAYNE, E. G. "A Program of Education in Accident Prevention and Methods and Results," *United States Bureau of Education*, Bulletin No. 32. 1922.
20. PETERSON, H. J. *The Teaching of Citizenship.* Houghton Mifflin Company. 1922.
21. ROBBINS, C. L. *The Socialized Recitation.* Allyn and Bacon. 1922.
22. REEDER, E. H. "A Method of Directing Children's Study of Geography," Teachers College, Columbia University, *Contributions to Education*, No. 193. 1925.
23. RUGG, H. O. "Needed Changes in Committee Procedure in Reconstructing the Social Studies," *The Elementary School Journal*, Vol. XXXI, pp. 688–702.

24. Rugg, H. O., and Hockett, John. "Objective Studies in Map Location," *Social Science Monographs,* No. 1. 1925.

25. "Ten Lessons in Thrift and Teaching Thrift in the Elementary Schools," United States Treasury Department. 1919.

26. "The Teaching of Community Civics," *United States Bureau of Education,* Bulletin No. 23. 1915.

27. Tryon, Rolla M. "Materials, Methods, and Administration of History Study in the Elementary Schools of the United States," *Indiana University Studies,* No. 17. 1912.

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE

CHAPTER XXV

THE PSYCHOLOGY OF NATURE STUDY

There are several schools of thought regarding the organization of the science curriculum in the elementary school. One group of workers holds that there should be no organized science curriculum in the elementary school but that facts of nature should be taught incidentally in connection with the other subjects. Another group contends that science instruction should have a definite place in the curriculum regardless of the way in which the curriculum is organized.

At present there seems to be little agreement as to what should be taught. Hillman,[1] in a study of thirty-six courses of study, found that only in six instances did a topic occur in the same grade in eighteen or more courses. From his study he concludes rightly that there should be more agreement concerning the science curriculum of the elementary grades.

In studying the topics listed in the courses of study, he tabulated them into three groups: animal life, plant life, and physical-chemical phenomena. When this was done it was found that 58.82 per cent of the emphasis given to plant life is limited to the primary grades, 19.04 per cent devoted to the grammar grades, and 22.05 common to both. In the same way 66.67 per cent of the topics dealing with animal life is devoted to the primary grades, 15.79 to the grammar grades, and 17.54 to both. In the physical-chemical phenomena, 29.85 per cent is devoted to the primary grades, 60.66 to the grammar grades, and 9.55 common to both.

---

[1] Hillman, J. E. "Science in the Elementary Schools," George Peabody College for Teachers, *Contributions to Education*, No. 14.

Historical. The field of nature study has received little attention from educational psychologists. Although a number of studies have been made regarding the topics offered and the subjects treated in the texts, practically nothing of an experimental nature has been done in the field. The studies, in the main, group themselves, according to Hillman, into three classes: (1) what children know about science, (2) the interest which children have in science, and (3) the grade levels at which materials should be presented.

The early investigations were chiefly concerned with what children know on entering school. These investigations dealt with the content of children's minds. One of the first studies was published by Bartholomai [1] in 1870. He asked children entering school such simple questions as, "Did you ever see a hare?" "Do you know what a mountain is?" About the same time, Longe [2] made a similar study for the purpose of finding deficiencies in the child's experiences as bases for determining the science instruction. G. Stanley Hall likewise investigated the content of children's minds. Later studies were concerned with high school students as well as children entering school.

---

[1] Hillman, J. E. *Op. cit.*, p. 1.

[2] Longe, Karl. Quoted by Hillman, J. E. "Some Aspects of Science in the Elementary Schools," George Peabody College for Teachers, *Contributions to Education*, No. 14.

On the hypothesis that science materials should be conditioned upon the intrinsic interest which children have in science, Finley[1] made some investigations of children's interests in science materials. His study related to two main problems: (1) what children wish to know about animals and (2) their interest in plants, animals, and physical phenomena. The questions asked by the children about the animal (a salamander) were classified under twelve heads:

Identification
Classification
Environment
Food
Life History
Adaptations
Movements
Geographical Distribution
Use
Habits
Structure
Teleological

He found children in the fourth grade interested primarily in identification, food, habits, and structure. Life history, geographical distribution, and adaptations were the topics of greatest interest in grade eight.

In the second part of his study he attempted to determine whether children are most interested in plants, animals, or physical phenomena. The results of his study showed, that for his material, children had the greatest interest in animals.

---

[1] Finley, C. W. "Some Studies of Children's Interest in Science Materials," *School Science and Mathematics*, Vol. XXI. 1921.

A contribution to the third phase of the science problem in the school has been made by Webb.[1] His study deals with a quantitative analysis of general science texts and the reaction of children of the sixth, seventh, and eighth grades to that analysis. Webb's contribution of greatest worth seems to lie in his findings with reference to the kind of scientific knowledge children in those grades can assimilate. His conclusions are as follows:

(1) A representative list of principles of science cannot be effectively presented to children of the fifth grade and below.

(2) In the sixth grade, physiology and physiography alone seem suitable for science instruction.

(3) In the seventh grade, biology, and possibly a most elementary treatment of physics.

(4) Physics acceptable for instruction in the eighth grade.

(5) Chemistry doubtful for science instruction in any of the grades.

Aims of nature study instruction. Good teaching always has some end in view. The nature study curriculum is different from most curriculums of the elementary school in that it deals almost exclusively with materials taken from the child's environment. It is imperative that teachers do not get lost in a wealth of nature material and lose sight of the things to be accomplished. The aims of instruction in this field at the University Elementary School of the University of Chicago were listed by Miss Parker[1] as seven in number. These aims substantially as she gave them are listed below:

---

[1] Webb, H. A. "General Science Instruction in the Grades," George Peabody College for Teachers, *Contributions to Education*, No. 4.

1. To employ the interests children have in manipulating materials and in seeing what will happen. Nature study provides opportunities for purposeful manipulation of materials.

2. The second aim is to allow the children to find answers to questions they are continually asking concerning natural phenomena. The course concerns itself with developing certain principles which the child can use in interpreting the scientific phenomena he observes.

3. The third aim is to satisfy the desire children have to learn the names of things. In the University Elementary School course, identification is seldom, if ever, regarded as an end in itself. Names are taught only as they are needed.

4. The interest which children have in the beautiful manifests itself in the study of trees, flowers, birds, etc. Materials should be presented in the nature study course in their natural state.

5. The science course offers an opportunity for the interest which children have in creative work to manifest itself.

6. A further aim of the nature study course is to provide for the building up of a fund of interesting science

---

[1] Parker, Bertha M. "The Course in Nature-Study and Science in the University Elementary School," *The Elementary School Journal*, pp. 116–125. October, 1923.

experiences in such a way as to develop, to some degree, a scientific attitude of mind, to give some idea of a scientist's method of attacking a problem. The contribution which the nature study course makes to the technique of problem-solving is in the command that it gives of the tools of first-hand observation and experimentation.

7. A further aim is to develop some notion of the part which science plays in the world today, some notion of the progress we have made in our manner of thinking since the time when myths, offered as explanations of their environment, satisfied people.

Nature study as related to children's interests. In the learning of any materials it is of major importance that children take an active interest in them. Not only does interest affect the immediate progress in learning but it is an important factor in retention. When a pupil is interested in a task he is able to give attention to the essential elements necessary for learning. Where interest is lacking there is fluctuation of attention inasmuch as the pupil is unable to give attention of long duration to things which are of little interest to him. In discussing the value of interest in learning, Horn [1] says, "It is not unlikely that a pupil will learn more readily with an inferior method coupled with vigorous interest, than with a superior method applied in a sluggish or indifferent manner. Fortunately, there is every reason to believe that an efficient method can be made just as interesting as an inefficient one."

---

[1] Horn, Ernest. "Principles of Method in Teaching Spelling as Derived from Scientific Investigation," *The Eighteenth Yearbook of the National Society for the Study of Education*, Part II, Chap. III.

The best place to secure materials for the study of nature is from the immediate environment. Children are interested, or may easily be led to become interested, in the things about them. The alert teacher will take advantage of the pupils' interests as manifested by their voluntary questions. The teacher should make a careful study of the environment and from this draw materials for projects for the nature study work. Children entering school bring some knowledge concerning the things about them. It is upon this knowledge, however meager, that the teacher must build interests.

Jordan [1] shows from a careful study of children's reading interests that there are rather large sex differences with respect to reading interests. Boys read much more from nature study magazines. Girls are more interested in adult fiction and articles dealing with woman's arts: sewing, homemaking, and the like. Jordan's findings are shown in Table LXXXI.

A number of other studies have been made relating to children's interests. Among others Trafton, Mau, and Downing [2] have studied children's interests in nature materials. In Trafton's study

---

[1] Jordan, A. M. *Children's Reading Interests.* University of North Carolina Press. 1926.

[2] Summarized in Courtis, Francis D. *A Digest of Investigations in the Teaching of Science*, pp. 119–131. P. Blakiston's Son & Company. 1926.

TABLE LXXXI. SHOWING TYPES OF MAGAZINES READ BY BOYS AND GIRLS AT DIFFERENT AGES

AGE		**12–13**	**14–16**	**17–18**
	B	62	484	149
	G	99	568	197
Adult Fiction	B	18.5	27.4	41.8
	G	30.7	41.1	40.2
Juvenile Fiction	B	17.9	9.3	3.8
	G	10.7	1.1	
Adventure	B	21.2	11.4	7.8
	G	2.3	1.8	1.0
Nature	B	5.2	5.3	5.1
	G	2.5	3.3	2.7
Pictures	B	.4	1.7	2.1
	G	10.3	10.3	5.5
Woman's Arts	B	3.4	1.4	1.1
	G	24.2	21.8	25.4
Science	B	17.8	16.7	13.3
	G	3.0	1.3	.6
Current Events	B	5.6	8.3	11.5
	G	5.1	8.6	15.7
Humor	B	2.6	8.0	8.2
	G	5.8	5.3	3.9
Miscellaneous	B	2.3	4.6	4.8
	G	3.8	3.2	3.1
No Choice	B	4.4	6.3	0.0
	G	1.4	2.8	1.9

the limited knowledge children have of the plants and animals in their surroundings was made plainly evident. The habits of animals were found to be of especial interest to children. Mau reported that the interest in animals was greater than any other in every grade. Different animals were found to appeal to children at different ages. Downing under-took, by means of a study of the questions sent to *St. Nicholas* through a period of years, to find out whether children have the greatest interest in animals, plants, or objects. An analysis of the questions revealed that more than half of these related to animals. Questions relating to plants were much less numerous, while a very small number related to objects. The findings of these studies show very clearly the need for further investigation concerning the materials to be used in teaching and their grade placement.

Organization in nature study teaching. One fault of much of our nature study teaching lies in the fact that the materials of instruction are of a varied character and hence difficult of organization. Good principles of teaching would seem to demand that the work of any grade have a thread of unity running through it. That is, the work of any grade should be such as to lead to definite generalization. If the work in nature study is not of this character and so organized that it can be summarized in a rather brief way so as to make certain principles stand out, it is of questionable value in the educative process. This is not only true of the work of a single grade, but the materials of instruction for all the grades should be so organized as to fit into a unified whole. Teachers in the higher grades should know what materials were given in the lower and should plan their instruction accordingly. If the work in nature study has been properly organized and presented, the graduate of the elementary school should not only know many facts of nature but he should have developed the ability to interpret and generalize as well.

The teacher and nature study. Probably in no subject does the success of the teaching depend more on the teacher than in nature study. Lack of knowledge of, and little interest in, the subject is the condition frequently found among teachers. The range of individual differences is so great here that we are likely to find many pupils far superior to their teachers in range of information and depth of interest. Conditions conducive to good learning certainly are not present when teachers are almost wholly unprepared to teach the subject to be learned. More adequate professional preparation, either by means of additional training or through a carefully prepared course of readings, is absolutely necessary in many cases if nature study is to be taught successfully.

Study habits in nature study. Although, in the main, the study habits employed in the various studies are the same, there are important differences. The abilities to be developed in nature study relate to careful and accurate observation and the ability to interpret the results of observation. The general laws of learning and the correlation of subject matter are probably of more importance with respect to the sciences than to any of the other fields of organized knowledge. Life situations and experiences are always rich enough to supply the school with an abundance of materials on which to build the nature study course. The innate and early acquired drives of the child can well be utilized by the trained teacher and made a valuable asset in motivating him to superior work. The nature study work is easily correlated with the work of the social sciences as well as with the more formal work of the school. Modern education, based to a large extent on scientific findings, is getting away from the notion of an isolation of the different skills and thought processes in which it was apparently assumed that no correlation exists between the different skills. All of life's activities are mutually interrelated, therefore materials should be presented to the child in such a way that definite workable units of work are comprehended.

In the study of a plant like the daisy there are many elements involved besides the materials present in the plant itself. Further study will show that the plant is similar in structure to other plants, and one can find some resemblance between the daisy and plants not of the same immediate phyla. Furthermore, the development of the plant is related to such factors as climatic conditions, kinds of soil, and seasons of the year. The growth and life habits of the plant are of primary importance. All these factors are necessary for a full understanding of the plant's life and, when these various relations are understood, the activity of the child in generalizing concerning plants of the same classification, or even of different classification, is greatly facilitated.

The development of scientific concepts. The child early in life begins to classify in a crude way the phenomena of nature which it observes. Objects are classified largely according to use and this kind of classification is carried over to natural events. When objects or events have similar features to those objects or events previously experienced, the child tends to classify accordingly. This is true only when his attention is directed toward these common features. The classification of objects becomes an important part of the activity of children in the early grades as information in the field of the natural sciences is acquired. Nature study provides for growth and development in that the child upon entering school has already acquired much information and has had such experiences as can easily be related to those of the school. In the assigned reading and during the free reading period he is given an opportunity to enlarge the scientific principles and ideas already partially established. Experiences and concepts are built up gradually and on information already at least to some extent acquired. Furthermore, these concepts must keep pace with the mental development of the child.

It must always be remembered that nature study presupposes simple, direct contact between the child and natural phenomena. Actual acquaintance with the things and processes of nature is necessary for successful nature study teaching. Pictures are rather poor substitutes for real objects and should be used only as a last resort or in summarizing and organizing first-hand information.

What science information do children possess? It has already been stated that natural science, or nature study, is very closely related to everyday experiences and it is for this reason that pupils oftentimes are highly motivated in their science work. There is little need for the introduction of abstract elements in the elementary work. All science materials in the early grades can be so correlated with everyday experiences that they are presented in concrete form and thus become a dynamic force in the work of the individual. Hillman[1] made a thorough study of the science information of children in the fourth, fifth, sixth, seventh, and eighth grades. The data collected in his study are of great value because he found by means of questions the subjects which are the most familiar to children and those least familiar.

The number and per cent of topics devoted to the primary grades (1–4) and the grammar grades (5–8), together with the amount of overlapping in the primary and grammar grades, are shown in Table LXXXII. These figures are taken from data compiled by Hillman from a study of the courses of study from fifteen states, nineteen cities, and two training schools. These courses of study were published in 1921–1922. The topics listed under agriculture, physiology, industrial arts, and similar subjects were not included in this study. No consideration was given the tabulation of the topics unless they occurred in the course of study as nature study or elementary science.

In Table LXXXII there is a noticeable overlapping in the primary and grammar grades. However, in regard to plant and animal life, the table shows that the topics are chiefly found in the primary grades. The topics relating to physical-chemical phenomena are largely found in the grammar grades.

---

[1] Hillman, J. E. *Op. cit.*, p. 35.

TABLE LXXXII. PER CENT OF TOTAL TOPICS IN PRIMARY GRADES (1–4), GRAMMAR GRADES (5–8), AND COMMON TO BOTH GRADES, BASED UPON TOTAL NUMBER OF INDIVIDUAL TOPICS (AFTER HILLMAN)

TYPES	TOTAL NO. OF TOPICS	NO. OF TOPICS IN PRIMARY GRADES	PER CENT OF TOPICS IN PRIMARY GRADES	NO. OF TOPICS IN GRAMMAR GRADES	PER CENT OF TOPICS IN GRAMMAR GRADES	NO. OF TOPICS COMMON TO BOTH GRADES	PER CENT OF TOPICS COMMON TO BOTH GRADES
Plant	136	80	58.82	26	19.12	30	22.05
Animal	171	114	66.67	27	15.74	30	17.54
Phys.-Chem. . .	211	63	29.85	128	60.66	20	9.57
Total	518	257	49.61	181	34.94	80	15.44

The questions which none of the children were able to answer are given below:

Why does it seldom frost on cloudy nights? (Very few attempted this question.)

What kind of eyes does a grasshopper have?

How would you know beggar ticks, common chickweed, and ragweed? (Practically no attempts)

Give, by means of examples, different ways by which seeds may be scattered.

Of what value is the sun to us?

What is the principle by which an object like a prism will reveal from sunlight the colors of the rainbow?

How are leaf prints made? (Very few attempts)

What changes do tadpoles make in passing from tadpoles to frogs?

Hillman points out the fact that only two or three of the questions under consideration here could have been answered on the basis of experience and observations from everyday life and apart from some instruction.

The following questions and problems were reacted to correctly by 50 per cent or more of the children:

Name five common minerals.
What are the different directions?
Name two evergreens used for Christmas decorations.
What is an evergreen tree?
From what materials are birds' nests built?
In what way is the toad beneficial?
Name five common fruits.
Name three trees whose leaves change their color in autumn.
For what are horses used?
Name three ways by which houses may be lighted.
Name five wild flowers.
Where do wild geese spend the winter?
Name two wild fruits.
Of what value are dogs?
Name four field crops.
How is the duck fitted for swimming?
Of what color is the crow?
Name three trees used for shade.
Name the seasons.

A study of the above tests will reveal that very little scientific knowledge is needed to answer them.

Of the total number of test statements answered correctly by less than 5 per cent of the children, 3 per cent dealt with scientific terms, 8.9 with definitions, and 13.9 with observational information. Of those questions answered correctly by 33 per cent or more, 5.1 per cent dealt with scientific terms, 7.7 with definitions, and 46.2 with observational information. With some degree of reliability it may be concluded that these children knew very little about scientific principles, that their knowledge, for the most part, consisted of the casual and observational type.

TABLE LXXXIII. WHAT CHILDREN IN GRADES 4–8 KNOW ABOUT DIFFERENT TYPES OF SCIENTIFIC KNOWLEDGE AS REVEALED BY THE AVERAGE PER CENT CORRECT SCORE WHICH EACH GRADE MADE (AFTER HILLMAN)

TYPE OF KNOWLEDGE	NUMBER OF QUESTIONS	GRADE				
		IV	V	VI	VII	VIII
Plant life	71	10.6	10.8	13.2	15.0	17.3
Animal life . . .	87	11.8	13.0	18.9	24.7	22.1
Chemical phenomena	4 and 6	2.5	1.6	2.8	3.9	5.4
Physical phenomena	60 and 6	8.2	12.0	15.3	17.9	19.6
Knowledge through observation . . .	50	19.9	21.0	24.3	28.1	27.9
Definitions	18	7.4	8.4	12.0	14.0	17.0
Scientific terms . .	12	7.9	8.0	11.0	24.5	17.5
Scientific principles .	51	3.1	5.2	7.0	11.3	9.7

Table LXXXIII summarizes the data and shows that children know most about animal life, that plant life ranks second, and that these are followed by physical phenomena and chemical phenomena in the order mentioned. This has some bearing on the materials which should be used in nature study and the order in which they should be studied.

Relation to other subjects. It is not unusual to find a pupil who is very poor in the elementary skills but who is very good in general information and who has developed a high degree of ability in making observations of the things in his environment. When this is true the child's knowledge of nature may very well be used for the purpose of motivating him in the more formal aspects of the curriculum. The child's interests in the facts of nature may successfully be used to enliven the, from his point of view, dull subjects, but care must be taken that his interests in nature continue to grow and are not destroyed by being coupled too closely with things for which he has no interest. The study of nature should be carried on in connection with activities involving geography, history, hygiene, and similar subjects. Children study the concrete forms of nature and learn to love all natural beauty. We may aid them in the development of appreciation for other materials by presenting nature in literature, history, geography, and even mathematics.

Appreciation in nature study. There are many influences about the child which aid him to develop an appreciation of nature. It is not to be expected that children from rural districts have the same kinds of interests in nature study that children from cities have. A teacher should understand that a difference in environment will produce a difference in interests. The types of teaching and the illustrations used must be in harmony with the child's earlier experiences if an appreciation of the laws of nature is to be developed. Appreciation may grow out of situations experienced in a large measure incidentally. Hillman [1] shows that many associations are formed by the child in activities apart from the work of the school. It is only by connecting the natural science work of the school with the materials learned in other activities that a full understanding will be acquired and the greatest amount of transfer obtained. In nature study are found many materials which are closely related to the innate nature of the child and to knowledge gathered incidentally. This is especially true for the boy in the country or small town who is in touch with animal life. Any enrichment of this knowledge which is meaningful to the child will aid in building up a fuller appreciation and understanding of nature. Furthermore, habits of observation and appreciation of the exactness of the laws of nature are factors of prime importance in relation to the development of attitudes and ideals conducive to the acquisition of further knowledge concerning nature.

Nature study as related to individual differences. Nature study can probably be adapted to individuals varying in interests and abilities better than most of the school subjects. The subject lends itself to work involving individual projects and interests. Children with different interests can approach the study from different points of view. Practically all children have enough intelligence to enjoy the subject. However, children with a high degree of intelligence are able to comprehend and untangle problems which children with less intelligence are unable to comprehend. Many elements and details of projects baffle the insight of the less intelligent of a group; yet all children have had experiences involving natural phenomena and there are probably none who do not have fundamental concepts already established which should be further enriched. Often one finds rather inferior children who have a deep interest and a large store of knowledge in some field of nature study. The abstract element is not so prominent in the more elementary phases of the subject. This makes it easier for inferior children to develop an interest in the study.

---

[1] Hillman, J. E. *Op. cit.*, p. 64.

QUESTIONS AND EXERCISES

1. Give a concrete illustration of the use of generalization in nature study.
2. Contrast the aims of nature study and of social science.
3. What are some of the elements to be measured in nature study? What types of tests can the teacher use to great advantage in measuring these elements?
4. Make five true and five false statements taken from the concepts arrived at in this chapter.
5. How is elementary science different from nature study? How similar?

6. Show how a knowledge of the findings of Hillman might be used to great advantage by the teacher.

7. Mention several methods of providing for individual differences in interests and ability.

8. In general, do you find children more interested in "what a thing is," "what it does," or "what can be done with it"? How does this interest change with the psychic development of the child?

9. In nature study what advantage do you think a child reared in the country would have over a child reared in the city? What disadvantages? How should this influence our training?

SELECTED REFERENCES

1. CALDWELL, O. W. *Science Teaching.* General Education Board, New York. 1919.
2. COURTIS, F. D. *Investigations in the Teaching of Science*, pp. 119–131. P. Blakiston's Son & Company. 1926.
3. FINLEY, CHARLES W. "Some Studies of Children's Interests in Science Materials," *School Science and Mathematics*, Vol. XXI. 1921.
4. HILLMAN, JAMES E. "Some Aspects of Science in the Elementary Schools," George Peabody College for Teachers, *Contributions to Education*, No. 14. 1924.
5. JUDD, C. H. "Initiative, or the Discovery of Problems," *The Elementary School Journal*, Vol. XIII. 1912.
6. LARUE, D. W. *The Child's Mind and the Common Branches*, Chap. XI. The Macmillan Company. 1924.

7. Libby, Walter, *et al.* "The Contents of Children's Minds," *Pedagogical Seminary*, Vol. XVII, pp. 242–272. 1910.
8. MacClintock, P. L. *Literature in the Elementary School*, Chap. X. The University of Chicago Press. 1907.
9. Parker, S. C. *Types of Elementary Teaching and Learning*, Chap. X. Ginn and Company. 1923.
10. Thorndike, E. L. "Education for Initiative and Originality," *Teachers College Record*, Vol. XVII, pp. 405–416. November, 1916.
11. Trafton, G. H. *The Teaching of Science in the Elementary Schools*. Houghton Mifflin Company. 1918.
12. Webb, Hanor A. "General Science Instruction in the Grades," George Peabody College for Teachers, *Contributions to Education*, No. 4. 1921.
13. Woodhull, J. F. *The Teaching of Science*. The Macmillan Company. 1918.
14. Wyss, C. V. *The Teaching of Nature Study*. A. and C. Black, Limited. London, 1927.

INDEX

Abilities functioning in musical education, 510
Ability and achievement in spelling, 361
Ability to learn, 102
Accomplishment quotient, 51
Achievement in arithmetic, 470
Aims of instruction in, arithmetic, 434; art, 496; handwriting, 405; language, 230; music, 508; nature study, 547; reading, 268; social studies, 527; spelling, 352
Alexander, Thomas, 286; 332
Allport, F. P., 185
Ancestral inheritance, 2
Arps, G. F., 360; 467
Ashbaugh, E. J., 355; 401; 403
Attention, 118
Ayer, Adelaide M., 541
Ayer, F. C., 493; 506
Ayres, L. P., 43; 386; 400–403

Bagley, W. C., 194; 541
Baldwin, B. T., 24; 35; 40
Barr, A. S., 372
Bassett, B. B., 541
Benson, C. E., 111
Binet, Alfred, 2–4; 42; 45
Binet-Simon Test, 44
Biological heredity, 16
Bobbitt, F., 231; 508
Book, W. F., 141; 175
Bourne, H. E., 541
Bronner, Augusta F., 141; 150; 158
Brooks, E. C., 541
Brooks, F. D., 286; 300; 331; 350
Brown, A. W., 141; 147; 150; 158
Brown, J. C., 450; 477
Buckingham, B. R., 43; 400
Buellesfield, Henry, 199
Burt, Cyril, 141; 145; 158; 362; 382; 392
Buswell, G. T., 272; 286; 291; 305; 324; 331; 452; 459; 474; 477

Caldwell, O. W., 563
Cameron, E. H., 40; 265; 331
Carey, Gertrude L., 504; 507
Castle, W. E., 40
Cattell, J. M., 304
Central tendencies, 65
Certain, C. C., 265
Chapman, J. C., 173; 185; 205
Charters, W. W., 205; 265
Child, C. M., 30; 40; 142
Children's interest in drawing, 499
Children's interest in nature study, 549
Clapp, F. L., 193; 444; 459
Clark, Edith M., 541
Coffman, L. D., 433; 460; 477
Conard, H. E., 467
Concept of environment, 29
Concept of heredity, 17
Conklin, E. G., 40
Contiguity, 116
Counts, G. S., 205
Courtis Arithmetic Tests, 7
Courtis, F. D., 550; 563
Courtis, S. A., 270
Courtis Standard Research Tests, 480

Cross, E. A., 262
Cubberley, E. P., 525
Cuff, Noel B., 139

Dashiell, J. F., 111; 228
Dearborn, W. F., 14; 35; 286
de Laguna, Grace, 228
Development of personality, 193
Development of rate in reading, 318
DeVoss, J. C., 142; 150; 156; 350; 404; 428; 484
Dewey, John, 406; 506; 525
Diebel, Amelia, 254; 266
Directed study in the social studies, 531
Donovan, H. L., 286; 332
Downing, E. R., 21; 40
Drills in arithmetic, 444
Drills in spelling, 374
Dunn, Fannie W., 276; 286

Ebbinghaus, H., 138
Economy in arithmetic study, 466
Edwards, A. S., 266; 331
Environmental influences, 32
Errors in spelling, 381
Experience, 118
Eye-movements, 323

Feder, R. B., 173; 185
Fenton, Norman, 58
Filial regression, 3
Finley, C. W., 546; 563
Franzen, Raymond, 51
Freeman, F. N., 14; 58; 111; 266; 331; 413; 424; 427; 506; 523

Galton, F., 2–4; 16; 42–45
Gambrill, J. M., 542
Garrett, H. E., 75; 90
Garrison, S. C., 6; 14; 47; 340; 366; 369; 420
Garth, T. R., 21; 40
Gates, A. I., 35; 111; 142; 158; 304; 328; 331; 364; 370; 393; 403; 473
Gaussian Curve, 11
Gavett, G. I., 75; 90
Gilchrist, E. P., 172; 185
Gilliland, A. R., 75; 350; 403; 428
Glass, J. M., 234
Goddard, H. H., 4; 40; 45; 474
Good, C. V., 312; 331
Goodenough, Florence L., 500; 506
Gray, C. T., 308; 326; 331; 350
Gray, W. S., 278; 286; 291; 331; 346
Gregory, C. A., 90; 350
Growth in language ability, 235

Habit and learning, 132–136
Hackler, J. M., 471
Handwriting as habit, 413
Harris, Julia M., 286; 332
Herring, J. P., 46
Hertzberg, O. E., 428
Hillman, J. E., 544; 563
Hincks, Elizabeth M., 142; 150; 158
Hollingworth, Leta S., 371; 383; 392; 403; 428; 491; 507
Holtzinger, K. J., 76; 90
Horn, Ernest, 310; 355; 380; 403; 534; 549
Huddleson, Earl, 237; 259; 266
Huey, E. B., 288; 305; 332
Hurlock, Elizabeth B., 170; 185

Imagery and spelling, 365
Individual differences, causes of, 16; importance of, 12; in arithmetic, 472; in ability to draw, 502; in handwriting, 422–424; in language, 258–

260; in nature study, 561; in the social studies, 535; nature and amount of, 4; provisions for in reading, 341–345
Inglis, Alexander, 234
Inheritance of musical ability, 513
Instinct and learning, 129
Intelligence, 56
Intelligence quotient, 47
Interest and motivation in reading, 313; 327

James, William, 443
Javal, Emile, 305
Jessup, W. A., 433; 437; 460; 477
Johnson, H., 542
Jordan, A. M., 111; 278; 286; 550
Jordan, R. H., 75; 350; 403; 428
Judd, C. H., 111; 272; 286; 312; 452; 459; 477; 563

Kelley, T. L., 51; 58; 76; 90
Kelly, F. J., 350; 404; 428; 477; 484
Kennedy-Fraser, David, 127
Kepner, T., 536
Kirby, T. J., 173; 185; 458
Klapper, P., 287; 477
Klauer, Naomi, 516
Klein, D. B., 112; 142; 164; 186
Kline, L. W., 504; 507
Kline, W. L., 367; 373
Knight, F. B., 185; 205; 455
Knowledge of progress, 174
Koffka, Kurt, 212; 228
Kuhlman, F., 45

Laird, D. A., 185
Language, 207
Language, a mode of reaction, 216; and social intercourse, 218–220; as habit, 217; as stimulus and response, 225; and thinking, 215
Leamer, E. W., 424
Learning, 92; 118
Left-handedness and handwriting, 417
Leighton, J. A., 205
Libby, Walter, 564
Lima, Margaret, 279; 287
Longe, K., 545
Lough, J. E., 111
Luse, Eva M., 455

MacClintock, P. L., 564
Manuel, H. T., 491; 507
Martin, G. E., 375
Maturity, 28
McCall, W. A., 346; 350
McCarty, Stella A., 499; 503; 507
Mead, A. R., 379
Mead, C. D., 367; 373
Mean, 68
Mean deviation, 80
Measurements in, arithmetic, 479; education, 42; handwriting, 421; nature study, 561; social studies, 535
Measures of relationship, 86; of variability, 85–86
Measuring spelling achievement, 398
Median, 69
Meier, N. C., 495; 504; 507
Mendel, 16
Mental age, 46
Mental organization, 106
Mental set, 325
Merrill, M. A., 474
Miles, D. H., 273; 287
Mode, 74
Monroe, W. S., 58; 205; 271; 350; 404; 428; 484
Moore, E. C., 439

Mort, P. R., 14
Morton, R. L., 460; 478
Motivation, 159
Motivation in spelling, 375
Motivation of composition work, 246

National Intelligence Test, 46
Newcomb, R. S., 478
Normal probability curve, 8–12
Norms, 51
Norvell, Lee, 175

O'Brien, J. A., 287; 320; 332
Odell, C. W., 76; 90
Ogden, R. M., 206
Oral reading, 290
Osburn, W. J., 460; 478
O'Shea, M. V., 373
Otis, A. S., 46; 76; 90

Parker, Bertha M., 548
Parker, S. C., 564
Paulu, E. M., 76; 404; 428
Perception of words, 303
Perceptual learning, 128
Perrin, F. A. C., 112; 142; 164; 186
Personality, the teacher's, 190
Peterson, Joseph, 3; 15; 18; 41; 58; 142; 317
Phelps, C. L., 444
Phillips, F. M., 458; 478
Physical and mental traits, 35
Physiological development, 24
Piaget, Jean, 224; 228
Pillsbury, W. B., 112; 142; 228
Pintner, R., 58
Pressey, Luella C., 76
Pressey, S. L., 76; 251; 256; 266
Pyle, W. H., 112

Random movements, 116
Rate of reading, 320
Rational Learning Test, 19
Reading, importance of, 267; and studying, 270; and the other subjects, 272; and intelligence, 282; children's interests in, 276
Reading readiness, 295
ReBarker, H., 445; 460; 470
Reed, H. B., 266; 332; 404; 428; 456; 460; 478
Remmers, H. H., 185
Reliability and validity, 53
Remedial instruction in spelling, 395
Remedial measures in reading, 345
Remedial treatment, handwriting, 424
Rice, J. M., 42
Robbins, C. L., 542
Romanes, G. J., 142; 148
Ross, C. C., 174; 186
Rowland, Eleanor M., 221
Rugg, Earle, 525
Rugg, H. O., 76; 91; 542

Sandiford, Peter, 112; 229
Sapir, E., 229
Schoen, Max, 523
School morale and motivation, 179
Scientific concepts possessed by children, 555
Sears, Isabel, 254; 266
Seashore, C. E., 510; 520; 523
Sentence structure, 255
Sex differences, 22
Shepherd, Edith, 249
Sigma, 82–85
Silent reading, 293
Sister M. Columba, 242; 244
Skill in drawing, 497
Skinner, C. E., 111
Smith, Dora V., 245
Smith, D. E., 430

Smith, Nila B., 439; 460
Smith, W. A., 229
Smith, W. R., 206
Snedden, D., 252
Social heredity, 17
Social motives, 161
Span of attention, 126
Spearman, C., 143; 144; 158
Special ability, 145–148; causes of, 148–150; and success or failure, 151–155; and classification of pupils, 155–157
Spontaneous movements, 109
Standard deviation, 82–85
Standardized tests, 52
Starch, D., 41; 112; 266; 365; 401; 404; 476
Stevenson, P. R., 478
Stimulus-response hypothesis, 97
Stone, J. C., 478
Strong, E. K., 41
Study habits in nature study, 553
Sullivan, Ellen B., 186
Suzzallo, H., 370; 373
Symonds, P. M., 206; 223

Taylor, J. S., 428; 433
Terman, L. M., 4; 27; 35; 41; 45; 50; 58; 239; 242; 279; 287
Theisen, W. W., 341
Thompson, C. J., 247; 266
Thorndike, E. L., 4; 41; 76; 91; 109; 112; 131; 143; 158; 259; 309; 355; 373; 404; 441; 475; 478; 504
Tidyman, W. F., 355; 365; 373; 378; 404
Trabue, M. R., 76; 258; 350
Trafton, G. H., 564
Transfer, 108
Transfer, in arithmetic, 469; in spelling, 378
Tressler, J. C., 253
Trial and error learning, 114

Uhl, W. L., 278; 287
Uses of standardized tests, 53

Van Wagenen, M. J., 350
Variability, measurement of, 85
Vocabulary growth, 299

Wallin, J. E. W., 373
Walter, H. E., 41
Watson, J. B., 229
Webb, H. A., 547; 564
Weismann, 16
Weiss, A. P., 225; 229
West, P. V., 111; 418; 428
Wheat, H. G., 287
Whipple, G. M., 127
Whitney, F. L., 197; 206
Wilson, F. T., 361
Wilson, G. M., 186; 236; 264; 266; 350; 438; 460
Wilson, H. B., 186
Wimmer, H., 454
Woodhull, J. F., 564
Woodrow, Herbert, 25; 41
Woodworth, R. S., 112; 143; 186
Woody Arithmetic Scales, 481
Woody, Clifford, 439
Woolley, Helen Thompson, 26; 37; 41
Wren, F. L., 471
Wright, W. W., 76; 350

Yoakum, G. A., 287
Yule, G. U., 9; 15; 76

LIBRARY OF
BIRMINGHAM-SOUTHERN COLLEGE

LIBRARY
OF
BIRMINGHAM-SOUTHERN
COLLEGE

LIBRARY OF
BIRMINGHAM SOUTHERN COLLEGE